BIOLOGICAL REPORT AND ECONOMIC ANALYSIS OF TRIFLURALIN

USDA/STATE/EPA ASSESSMENT TEAM OF THE
NATIONAL AGRICULTURAL PESTICIDE IMPACT ASSESSMENT PROGRAM
UNITED STATES DEPARTMENT OF AGRICULTURE

BIOLOGICAL REPORT AND ECONOMIC ANALYSIS OF TRIFLURALIN

United States Department of Agriculture

and

State Land Grant Universities

and

United States Environmental Protection Agency

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BIOLOGICAL REPORT

BIOLOGICAL INFORMATION IN SUPPORT OF ECONOMIC ANALYSIS

United States Department of Agriculture
Agricultural Research Service
Economic Research Service

And

State Land Grant Universities

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Introduction

The biological information for this report was developed by a group of knowledgeable weed scientists and economists which comprised the National Herbicide Assessment Team for Trifluralin. The members who worked on the various crops or commodities have had years of research and extension experience with the crop and with weed control problems in those crops. Due to the time frame available for completing this report, there are some informational gaps. These we hope to develop more fully as time permits.

The development of the biological information was a joint effort between USDA (ARS and ERS) and the State Land Grant Universities.

NATIONAL HERBICIDE ASSESSMENT TEAM

for Trifluralin (Treflan)

St. Louis, Missouri

March 9, 10, and 11, 1977

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BIOLOGICAL INFORMATION IN SUPPORT OF
ECONOMIC ANALYSIS

COTTON - Region 2

1. Planted acres. 1971-76 average — 785,000 (120)

   Cotton is an important crop in the states comprising Region 2. However, it is not produced on extensive acreage in these states, particularly in Virginia and North Carolina

2. Yield per acre - 1971-76 ave. — 405 lbs./A. (120)

3. Acres treated with herbicides: 1975-76. (110)
   Expressed as % of planted acres — 80%

   Treflan alone - 10% — 78,500

   Treflan mixed with other herbicides - 45% — 353,250

   Other dinitroanilines - 10% — 78,500

4. Alternative herbicides to Trelfan (other dinitroaniline herbicides not considered) (1,2,12,13,48,81,110,121)

   a. Fluometuron — 1.5#/A. active

   b. Karmex — 0.75#/A. active

   c. Caparol — 2.0#/A. active

   These herbicides are presently used for weed control in cotton in Region 2, but not as extensively as Treflan. They are not as effective in controlling grass species as Treflan. With some species such as Johnsongrass and Texas panicum, they are completely ineffective.

5. Yield difference: Treflan vs. (1,2,12,13,110)

   a. Other dinitroanilines — None

   b. Other herbicides

      1. Fluometuron — 2% loss — 397 lbs./A.

      2. Karmex — 3% loss — 393 lbs./A.

      3. Caparol — 3% loss — 393 lbs./A.

Cotton - Region 2

5. Each of these herbicides lacks the consistency of performance of Treflan. Being surface applied, they are subject to photo decomposition, blowing by wind and movement by rainfall. (110)

   c. Cultivation

      1. No extra cultivation plus the alternative herbicides - 20% loss in yield on 20% of Treflan treated acres. 324 lbs/A.

      2. Extra cultivations - 2% loss in yield on 65% of Treflan acres. 397 lbs./A.

      3. Extra cultivations plus hand hoeing - zero loss in yield on 15% of Treflan acres. 405 lbs./A.

   If there were adequate supplies of dinitroaniline herbicides other than Treflan available, there would probably not be a loss of yield of cotton. However, if Treflan were removed and control measures attempted with other herbicides and/or mechanical means, there would be a 2 to 3 percent loss in yield. This would be primarily because of "escape" grassy weeds, particularly Johnsongrass, Texas panicum and fall panicum.

   Cotton grown only with cultivation would suffer yield losses of at least 40%. The inclusion of hoeing along with cultivation would enable about normal production of cotton.

6. Changes in commodity quality. (110)

   a. Dockage percentage __________

   b. Cleaning costs, per unit __________

   c. Lower grade 10% loss on 55% of acreage

   The removal of Treflan from the cotton weed control program would unquestionably result in more grass weeds at harvest. This would occur even with maximum use of alternative herbicides and other means of effecting weed control. The resulting presence of grass weeds would probably mean at least 1 grade loss in quality, leading to a 10% loss of value.

7. Percent of acres treated with alternative herbicide that may not receive sufficient rainfall to activate the herbicide after application. 25% (110)

   Herbicides other than Treflan and the dinitroanilines that are used in cotton for preemergence weed control

Cotton - Region 2

7. are surface applied. As such, they require rainfall or moisture for activation. Because of the unpredictable nature of rainfall in much of the eastern U.S. where cotton is grown without irrigation, performance of preemergence herbicides will be more variable.

8. Percent of acres treated with alternative herbicides that may not receive first cultivation at the optimal time. — None (110)

   All acres are treated with some herbicide.

9. Increase in number of cultivations if alternative herbicides are used. — 2 additional (110)

   The loss of Treflan would require additional cultivations to maintain an acceptable level of weed control. Even with these additional cultivations, there would still be a need for substantial hand labor to remove "escape" weeds. A conservative estimate of additional hand labor would be 4 hrs/A.,or $10.00/A. additional costs.

10. Hand labor if applicable. — 4 hrs./A. (110)

    a. Number of acres 55,000

    b. Cost per acre per season $10.00

11. Shift to other crops — Limited - if any (110)

    The logical shift would be to soybeans. Without Treflan, such a shift would be undesirable because Treflan is the most widely used herbicide in soybeans.

12. Price of herbicide materials: per gal, lb., etc. — (110)

    a. Treflan — $7.50/lb. active

    b. Alternatives

       1. Fluometuron — $5.32/lb. active

       2. Karmex — $3.00.lb. active

       3. Caparol — $4.00/lb. active

    Prices quoted are current average prices and would likely be pushed upward if demand for them increased sharply.

BIOLOGICAL INFORMATION IN SUPPORT OF
ECONOMIC ANALYSIS

COTTON - Region 4

1.	Planted acres. 1971-76 ave.		4,138,000 (120)
2.	Yield per acre		417 lbs./A. (120)
3.	Acres treated with herbicides: 1975-76		100% (110)
	a. Treflan alone -	5%	206,900
	b. Treflan mixed with other herbicides	85%	3,517,300
	c. Other dinitroanilies	10%	413,800

Treflan is used on 90% of the cotton acreage in Region 4, which comprises the mid-south states or "Delta." Of this 90%, at least two herbicides are used on 85% of the acreage. (12,13,41,110)

4. Alternative herbicides to Treflan. Average rate of Treflan 0.75#/A. active. (12, 13, 110)

a.	Cotoran	1.5#/A. active
b.	Karmex	1.0#/A. active
c.	Zorinal	2.0#/A. active
d.	Caparol	2.0#/A. active

The weed complex in cotton in this area is comprised of many annual and perennial grass species, as well as, broadleaf weeds. Treflan has been particularly effective in controlling annual grass species and at least one perennial grass (Johnsongrass). (1,2,110)

The alternative herbicides available to the cotton farmer to use in lieu of Treflan are not as effective in control of grass species and are not as consistent in performance.

5. Yield difference: Treflan vs. (1,2,12,13,31,110)

a.	Other dinitroanilines	1%	413

Less effective on Johnsongrass

Cotton - Region 4

5. b.	Other herbicides:		(1,2,12,13,110)
	1. Cotoran	2% loss	409
	2. Karmex	3% loss	405
	3. Zorinal	3% loss	405
	4. Caparol	3% loss	405
c.	Cultivation only	40% loss	243
d.	No extra cultivations on 20% of acreage	10% loss	375
e.	Extra cultivations on 75% of acreage	3% loss	405
f.	Extra cultivations plus hand hoeing on 5% of acreage	1% loss	413
g.	Cultural practices		
	1. Change in planting date		not helpful
	2. Rotations		not helpful

If Treflan became unavailable, essentially all coton will still receive at least one application of herbicides. This is because 85% of the cotton acreage already receives at least one application. Even if all cotton does receive at least one application of herbicides, grass control will be sufficiently poor to result in a modest reduction in yield. (110)

6.	Change in commodity quality	(110)
a.	Dockage percentage	Not applicable
b.	Cleaning cost, per unit	Not applicable
c.	Lower grade - a reduction of at least one grade - average of 10% on 90% of acreage	10% on 90% of acreage
7.	Percent of acres treated with alternative that may not receive sufficient rainfall to activate the material after application	(110) 35%

Cotton - Region 4

8. Percent of acres treated with herbicides that may not receive first cultivation at the optimal time. — 25% (110)

9. Increase in number of cultivations if alternative herbicide is used. — (1,2,12,13,110) 2 additional

10. Increase in number of cultivations if no alternative herbicide is used. — (1,2,12,13,110) Not applicable

11. Hand labor if applicable. — (110)

    90% of acreage would probably need it, but labor would not be available. Probably 5% of acreage would be covered.

12. Shift to other crops — Not likely (110)

    Probably the most significant effect of the removal of Treflan would be the release of grass weed species. Within a five year period, there will be a substantial increase in grass weed pressure. Johnsongrass, Texas panicum and fall panicum will be some of the species to make strinking increases in population and resulting competition to cotton and costs of production.

13. Prices of herbicide materials: per gal., lb., etc. (110)

    a. Treflan — $7.50/lb. active

    b. Alternatives

        1. Cotoran — $5.32/lb. active

        2. Karmex — $3.00/lb. active

        3. Zorinal — $5.00/lb. active

        4. Caparol — $4.00/lb. active

BIOLOGICAL INFORMATION IN SUPPORT OF
ECONOMIC ANALYSIS

COTTON - Region 6

1.	Planted acres - 1971-76 ave.		1,444,000 (120)
2.	Yield per acre - 1971-76 ave.		957 lbs./A. (120)
3.	Acres treated with herbicides: 1975-76		80% (110)
a.	Treflan alone	65%	938,600

Treflan is used primarily by itself because of reliable weed control and fewer residue problems in crop rotation.

b.	Treflan mixed with other herbicides	10%	144,400

Most of the Treflan combinations are with Caparol. In Arizona, a considerable acreage, about 20%, is applied as a preplant combination. The remainder of the Caparol is applied as early postemergence or layby treatments.

c.	Other dinitroanilines	5%	72,200

4. Alternative herbicides to Treflan (other dinitroaniline herbicides not considered) (1,2,14,15,24,51,52,53,54,55,63,110)

a.	Dacthal	9#/A. active
b.	Prefar	2#/A. active
c.	Caparol	1.6#/A. active

Dacthal and Prefar have been available to cotton growers for many years. Grower acceptance has been limited to less than 5% of the planted acreage. Both herbicides have been less effective on the spectrum of weeds and are more costly than Treflan.

Caparol is effective for broadleaved weed control but most grasses are not controlled. Most Caparol applications are applied with or following an application of Treflan to control the weeds resistant to Treflan. Increased rates of application of Caparol will not control grass species such as panicums, sprangletop, or Johnsongrass.

Cotton - Region 6

4. Karmex is also a broadleaved herbicide, but has more activity against grasses than does Caparol. However, it cannot be used effectively or safely as a preplant treatment. Rates sufficient for grass control often injure cotton and create a more likely probability of injury to other crops in the rotation due to residual carry-over. Cotton growers would be reluctant to accept the increased use of Karmex in cotton because of this residual carry-over. (1,2, 14,15,110)

   Cotoran has been an erratic performing herbicide in the West. Weed control with this product has not been adequate. It cannot be considered as a substitute for Treflan.

5. Yield difference: Treflan vs. (1,2,14,15, 54, 110)

   a. Other dinitroanilines: Other dinitroaniline herbicides were not considered as substitutes

   b. Other herbicides

1.	Dacthal	5% loss	909 lbs./A.
2.	Prefar	10% loss	861 lbs./A.
3.	Caparol	20% loss	766 lbs./A.

   In the short term, adequate supplies of alternative herbicides would not be available. Sufficient Dacthal for 5% of the Treflan acreage is all that could be considered. Some increase in Caparol use should be expected. Karmex for postemergence use would also increase and would be considered under 5b-3 above.

   Weed control with Prefar and Dacthal would not be as effective on the spectrum of weeds compared to Treflan. Prefar does not control any broadleaved species. Dacthal would result in less effective weed control. In the long run, if adequate supplies of Dacthal, Prefar, and Caparol were available, an improvement in weed control should be expected.

   c. Cultivation only 718

   Acres receiving cultivation only would include those fields with minimum weed problems, plus

5\. c. those where other methods of control were unavailable. Yields could be reduced 90% or more where weed pressures were severe. Tractors and cultivators would be set closer to the row and driven more slowly, thus increasing costs of these operations. More tractors and cultivators would be required for timely operations.

d. Cultivation and hand hoeing . 861 lbs./A.

Where cultivation and hoeing are used, yields should be effected. The availability of adequate labor for hoeing is very questionable. If labor was available, it would be relatively untrained and inexperienced.

e. Cultural practices

Cultural practices such as a change in planting dates or crop rotations would not offer any relief in the short run. Crop rotation could, in the long run, be helpful for the most difficult weed problems. Alfalfa, vegetables, grain sorghum, and small grains in the rotation with the available herbicides in these crops would provide some measure of weed control

6\. Changes in commodity quality (110)

a. Dockage percentage . None

b. Cleaning costs, per unit None

c. Lower grade - a reduction of at least one grade 3% to 10%

Changes in cotton quality and grade due to weed competition are not well understood. Where grass is a problem during harvest, grassy or green stained cotton lint is common. Further losses from excessive trash, barky cotton, etc. would vary with the type of weeds and their severity.

7\. Percent of acres treated with alternatives that may not receive sufficient rainfall to activate the material after application (110) None

The region is not dependent on rainfall for activation of herbicides. Total acreage is irrigated.

Cotton - Region 6

8. Percent of acres treated with no herbicide that may not receive first cultivation at the optimal time. — 20% (110)

If herbicides were in short supply and growers were forced to rely on cultivation and/or hoeing for weed control, there would be insufficient tractors and cultivators to fill the need. There would be a need for closer cultivation, resulting in slower tractor speeds of 2 to 3 m.p.h. as compared to 5 to 6 m.p.h. This would add to the cost of production.

9. Increase in number of cultivations if alternative herbicides are used. — (1,2,14,15,110) one additional

10. Increase in number of cultivations if no alternative herbicide is used. — (1,2,14,15,110) three additional

Without any herbicide, cultivation requirements would increase by at least three. Weed control would not be adequate on some acreage and energy use would increase.

11. Hand labor if applicable — (110)

a. Number of acres — 20% — 288,800

A shift to hand labor on 288,800 acres would be improbable. The cost estimate of \$45/A. is very conservative.

b. Cost per acre per season — \$45/A.

12. Shift to other crops — None (110)

A shift to other crops in the short term is not likely because of the favorable current price of cotton at .60¢ per pound. In the long run, without sufficient quantities of effective herbicides, growing costs would probably shift exceed .60¢ per pound. Growers would shift to other crops that were more competitive with weeds or in which herbicides could be used. However, this would be effective on only a limited acreage. If cotton and soybean acreages were shifted to corn, grain sorghm, small grains, and alfalfa, prices in these areas would decline rapidly.

13. Price of herbicide per gal, lb., etc. — (110)

a. Treflan — \$7.50/lb. active

b. Alternatives

1. Dacthal — \$3.53/lb. active

Cotton - Region 6

13. b. 2.	Prefar	$4.11/1b. active
3.	Caparol	$4.00/1b. active

Prices quoted are current and would likley be pushed upward if demand for them increased sharply. Dacthal and Prefar would be worth more for use on horticultural and vegetable crops than for cotton. Caparol, used mostly on cotton would be in very short supply.

BIOLOGICAL INFORMATION IN SUPPORT OF
ECONOMIC ANALYSIS

COTTON - Region 7

1. Planted acres - 1971-76 ave. 5,591,000 (120)

2. Yield per acre - 1971-76 ave. 326 lbs./A. (120)

3. Acres treated with herbicides: 1975-76 4,754,000 (110)
85% of planted acres treated

a.	Treflan alone	50%	2,795,500
b.	Treflan mixed with other herbicides	5%	279,500
c.	Other dinitroanilines	8%	444,700

Eighty-five percent of the planted acreage is treated with herbicides. Fifty percent of the planted acres get Treflan alone, applied primarily as a preplant herbicide that is incorporated with a disc. This discing operation is not extra. It is needed for seedbed preparation. Five percent of the acreage gets both Treflan and another herbicide. A total of 55% of the acreage gets Treflan.

4. Alternative herbicides to Treflan (do not consider other dinitroanilines) (1,2,12, 13, 110)

a.	Caparol	1.5#/A. active
b.	Lasso	1.5#/A. active
c.	Karmex	1.0#/A. active

Alternative preemergence herbicides are Caparol, Lasso, and Karmex. They will be used on a total of 280,000 acres that normally received Treflan only--assuming Treflan were not available. There will be a yield loss on this land because it probably will not be hoed. There is not enough labor at any price. Of the 2,795,500 acres primarily treated with Treflan, 70% will not get a herbicide treatment, but will need three extra cultivations. This represents 1,957,000 acres. Ten percent will get two cultivations plus a hand hoeing at an average cost of $20.00 per acre.

Cotton - Region 7

5. Yield difference: Treflan vs. (1,2,12,13,110,111)

   a. Other dinitroanilines — None

   b. Other herbicides

1. Caparol	5% loss	140,000
2. Lasso	5% loss	84,000
3. Karmex	10% loss	56,000

The above acreage figures based on 5% of Treflan alone acres for Caparol, 3% for Lasso, and 2% for Karmex.

   c. Cultivation only - 70% of Treflan alone — 1,957,000

   d. Cultivation plus hand hoeing — 10% of Treflan alone — 280,000

   e. Rotate to sorghum — 10% of Treflan alone — 280,000

In the long run, yield losses on land that is only cultivated will increase. Johnsongrass will become a more serious problem if the dinitroanilines herbicides are not available. The same will be true for many annual grass species. Yield loss for uncultivated, unhoed acreage would increase to 40% in five years. Yield lossess where Caparol, Lasso, and Karmex are used would increase to 10 and 20 percent. If current preemergence herbicides were the only materials available, there would not be any cotton acreage in Region 7 that was cultivated and not hand hoed.

In the short run, there would be a grade loss on 50% of the cotton produced on Treflan treated acres. This would mean a 3% price cut on 1,537,500 acres which normally received Treflan.

6. Change in commodity quality (110)

   a. Dockage percentage — None

   b. Cleaning costs, per unit — None

   c. Lower grade - lower quality 1 grade on 50% of acreage normally treated with Treflan alone. — 3% loss in price

Cotton - Region 7

7. Percent of acres treated with alternative that may not receive sufficient rainfall to activate the chemical after application. — 154,000 (110)

   50% of 308,000 acres

8. Percent of acres treated with no cultivation that may not receive first cultivation at the optimal time. — (110) 768,000

   25% of 3,075,000

9. Increase in number of cultivation if alternative herbicides are used. — (1,2,12,13,110) 2 additional on 280,000

10. Increase in number of cultivations if no alternative herbicides is used. — (1,2,12,13,110) 3 additional on 1,957,000

11. Hand labor if applicable — (110)

    a. Number of acres — 280,000

    b. Cost per acre per season — $20.00

    Represents eight hours of labor at 2.50 per hour. This hand hoeing is in addition to 3 additional cultivations in Item 10.

12. Shifts to other crops — (110)

    a. Sorghum — 10% of Treflan alone — 280,000

13. Price of herbicide materials: per gal, lb., etc. — (110)

    a. Treflan — $7.50/lb. active

    b. Alternative

       1. Caparol — $4.00/lb. active

       2. Lasso — $4.00/lb. active

       3. Karmex — $3.00/lb. active

BIOLOGICAL INFORMATION IN SUPPORT OF ECONOMIC ANALYSIS

GRAPES - U.S.

1. Planted acres. 1973-75 ave. 4,506,150 (120)
   a. Acreage in California 525,000
2. Yield per acre: 1973-75 (120)
   a. California 8 tons/A.
   b. Remainder of U.S. 6 tons/A.
3. Acres treated with herbicides: 1975-76 (110)
   75% of California acreage 393,750
   Treflan alone - 2% of established acreage 10,500
   Treflan and other herbicides - 4% on established in Calif. 21,000
   10% of Calif. acreage replanted each year (52,500 acres), 80% is treated for annual weed control 42,000
   Other dinitroanalines - on replanted acreage, 20,00 treated with Surflan.
4. Alternative herbicides to Treflan (1,2,14,15,110)
   a. Casoron
   California will not recommend
5. Yield difference: Treflan vs. (1,2,14,15,45,76,77,110)
   a. Other dinitroanilines None
   b. Other herbicides;
      1. For California None
   c. Cultivation only Not applicable
   d. Cultural practices Not applicable
6. Change in commodity quality None
7. Percent of acres treated with alternative that may not receive sufficient rainfall to activate the material after aplication None
   All California acreage under irrigation
8. Percent of acres treated with alternative that may not receive first cultivation at optimal time (110) None
9. Increase in number of cultivations if alternative herbicides are used (110) No alternatives

10. Increase in number of cultivations if no alternative herbicide is used. (1,2,110)

    Four discings at $5.00 per acre and French plow once at $10 per acre. Applies to acreage in 3a and 3b.

11. Hand labor if applicable (110)

    a. Number of acres — 31,500 acres

    b. Cost per acre per season

       12 hrs. at 2.75 — $27.50

12. Shifts to other crops — No shifts (110)

13. Price of herbicide materials: per gal., lb., etc. (110)

    a. Treflan — $7.50/lb. active

       Treflan is used primarily for perennial weed control at rate of 2# per acre broadcast.

       On replanted acres, no hand labor used first year, but in 2nd and 3rd year, 50% of the acreage will need treatment for perennial species.

       On replanted acres in first year, Devrinol is used for annual weed control. Casoron will substitute for Treflan but Calif. doesn't recommend it.

BIOLOGICAL INFORMATION IN SUPPORT OF ECONOMIC ANALYSIS

GUAR AND MUNG BEANS - U.S.

1. Plamted acres - 1976 — 81,500 (120)
   a. Guar 55,000 acres
   b. Mung Beans 26,500 acres

2. Yield per acre - 1976 (120) — Guar - 1200 lbs/A. Mung Bean- 1,000

3. Acres treated with herbicides: 1976 (110)
   a. Guar 26,500
   b. Mung Bean 20,000

   1. Acres treated with Treflan
      (a) Guar 26,500
      (b) Mung Bean 20,000
   2. Treflan mixed with other herbicides ______
   3. Other dinitroanilines ______

4. Alternative herbicides to Treflan (do not consider other dinitroanilines) (1,2,12,13,110) — None

5. Yield difference: Treflan vs. (1,2,12,13,110)
   a. Other dinitroanilines — None
   b. Other herbicides — None
   c. Cultivation only — 20% of acreage
   d. Cultural practices — No change

6. Change in commodity quality — No change (110)

7. Percent of acres treated with alternative that may not receive sufficient rainfall to activate the herbicide — None (110)

8. Percent of acres treated with alternative herbicides that may not receive first cultivation at the optimal time, after planting. — None (110)

9. Increase in number of cultivations if alternative herbicides are used — No alternatives (1,2,12,13,110)

10. Increase in number of cultivations if no alternative herbicide is used — 2 additional

11. Hand labor if applicable — None used (110)

12.	Shifts to other crops	(110)	23,000 acres to wheat
13.	Price of herbicide materials: per gal., lb., etc.		(110)
	a. Treflan		7.88/lb. active
	b. Alternatives		None

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BIOLOGICAL INFORMATION IN SUPPORT OF

ECONOMIC ANALYSIS

MINT - U. S.

1. Planted acres - 1974-75 ave. 91,350 (1,2,1,10,14,1

2. Yield per acre - 1974-75 ave. 55 lbs. oil/A.

3. Acres treated with herbicides: 1975-76 86,783

   a. Treflan alone 7,040

      Treflan registered in west only. 10% of Washington and Oregon acreage treated

   b. Treflan mixed with other herbicides None

   c. Other dinitroanilines None

4. Alternative herbicides to Treflan (do not consider other dinitroanilines) (1,6,7,14,15,110)

   a. Sinbar 2.0 lbs./A. active

5. Yield difference: Treflan vs. (1,6,7,14,15,110)

   a. Other dinitroanilines

   b. Other herbicides

   c. Cultivation only

   d. Cultural practices No change

6. Change in commodity quality None (110)

7. Percent of acres treated with alternative that may not receive sufficient rainfall to activate the chemical after application None (110)

8. Percent of acres treated with alternative herbicides that may not receive first cultivation at the optimal time (110)

9. Increase in number of cultivations if alternative herbicides are used. (110)

10. Increase in number of cultivations if no alternative herbicide is used (110)

11. Shifts to other crops

12. Hand labor if applicable

    a. Number of acres

b. Cost per acre per season ______________

13. Price of herbicide materials: per gal., lb., etc. ______________ (110)

a. Treflan $7.88/lb. active

b. Alternatives

1. Sinbar 16.25/lb. active

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BIOLOGICAL INFORMATION IN SUPPORT OF

ECONOMIC ANALYSIS

PEANUTS - Region 7

1. Planted acres - 1974-76 ave. 215,200 (120)

2. Yield per acre - 1974-76 ave. 1,569 #/A. (120)

3. Acres treated with herbicides: 1975-76 95% 204,000 (110)

   a. Treflan alone - 55% of planted acres 118,400

      Treflan is registered for weed control in peanuts in Texas and Oklahoma. It is estimated that 95% of the peanut acreage in this area is treated with herbicides. Of this, Treflan is used on 70% of the acreage.

   b. Treflan mixed with other herbicides. Used on 15% of planted acreage 32,300

   c. Other dinitroanilines. Used on 5% of of planted acreage 10,700

4. Alternative herbicides: (do not consider other dinitroanilines) (1,2,12,13,28,59,65,110)

   a. Lasso 2.5#/A. active

   b. Vernam 2.5#/A. active

      Lasso and Vernam are possible alternative herbicides assuming the absence of Treflan. Each of these herbicides are presently labeled and used to some extent for weed control in peanuts. However, they have some deficiencies which preclude their complete substitution for Treflan. Lasso has good activity on some weed species, particularly, grasses, with the notable exception of Texas panimum. It is somewhat more expensive than Treflan and generally less consistent in performance. Vernam, while generally comparable in consistency of performance to Treflan, is more likely to injure peanuts, particularly when used in conjunction with postemergence treatments of dinoseb.

5. Yield difference: Treflan vs. (1,2,12,13,5965,110)

   a. Other dinitroanilines 5% loss in yield

   b. Other herbicides

      1. Lasso - on 6,000 acres 10% loss in yield

      2. Vernam - on 12,000 acres 10% loss in yield

d. Cultural practices (1,2,12,13,110)

1.	No cultivation	7,500 acres	50% loss in yield
2.	Cultivation	120,000 acres	15% loss in yield
3.	Cultivation + hand hoeing	22,500 acres	5% loss in yield

Considering the 79% of peanut acreage presently receiving Treflan, 5% will receive an additional cultivation. This will result in a 50% loss of peanut yield. Eighty percent of the acreage will be cultivated 2 additional times. Even with these additional cultivations, there will still be a 15% yield loss. It is anticipated that 15% of the peanuts normally treated with Treflan will be cultivated and hand hoed. Peanuts managed in this fashion will yield 5% less than when treated in a similar way that included Treflan.

6. Change in commodity quality (110)

a. Dockage percentage — None

b. Cleaning costs, per unit — None

c. Lower grade — No

Peanuts grown in heavy grass populations are more difficult to harvest compared to weed-free peanuts. The grasses tend to strip the pods from the vine during the digging process. Of the harvested nuts, however, there is no expected dockage or increased cleaning cost due to weeds.

The loss of Treflan for weed control in peanuts would add the requirement for additional cultivations. One of these cultivations would be with the rotary hoe or rolling cultivator and the remainder by conventional sweeps.

7. Percent of acres treated with alternative that may not receive sufficient rainfall to activate the chemical after application. (110) — None

8. Percent of acres treated with no herbicide that may not receive first cultivation at the optimal time. (110) — 40 % of acreage

9. Increase in number of cultivations if alternative herbicides are used (110) — 2 additional

10. Increase in number of cultivations if no alternative herbicide is used. — 3 additional (1,2,110)

    Cost of each cultivation $5.00/A.

11. Hand labor if applicable — (110)

    a. Number of acres — 11,800

    b. Cost per acre per season — $15.00

    Use of hand labor for grass control in peanuts is complicated because of the difficulty of removing grass weeds by hoeing. It is anticipated that 15% of the acreage can be hand hoed during the early part of the season.

12. Shifts to other crops — None expected (110)

13. Price of herbicide materials: per gal., lb., etc. — (110)

    a. Treflan — $7.50/lb. active

    b. Alternatives

    1. Lasso — $4.00/lb. active

    2. Vernam — $3.00/lb. active

The loss of Treflan would have far more serious long range reprecussions than short range. Treflan has been largely responsible for the reduction of the problem of grass weeds in the past several years. If Treflan were not available, the grass population would increase substantially and increased losses due to weed competition would result.

Alternatives to Treflan (1,2,12,13,28,59,65,110)

	Herbicide	Rate lb. AI/A	Addit. Cult.	YIELD LR	YIELD SR	YIELD	3(a) LR	3(a) SR	3(b) SR&LR	Acre Cost of Herb.
1.	Treflan	0.75	0	2 normal cult.		1569	118,000		32,000	3.60
2.	Lasso	2.5	2	13%	10%	1412	75%	5%	75%	10.00
3.	Vernam	2.5	2	13%	10%	1412	20%	10%	25%	7.50
4.	Extra Cult. (only)	--	3	20%	15%	1334	--	70%		--
5.	Extra Cult. and Hoe	--	3	5%	5%	1491	5%	10%		--
6.	No Extra Cult.	--	2 normal cult.	50%	50%	780	--	5%		--

For 3(b) = T + OH (Lasso and Vernam)

The Lasso and Vernam would be used alone and two added cultivations would substitute for the Treflan.

LR = long range

SR = short range

BIOLOGICAL INFORMATION IN SUPPORT OF
ECONOMIC ANALYSIS

SOYBEANS - Region 2

1. Planted acres - 1974-76 ave. — 5,000,000 (120)

2. Yield per acre - 1974-76 ave. — 22 bushels (120)

3. Acres treated with herbicides — 4,500,000 (110)

   a. Treflan alone — 1,600,000

   b. Treflan mixed with other herbicides — 900,000

   c. Other dinitroanilines — 300,000

4. Alternative herbicides to Treflan (do not consider other dinitroanilines) (1,2,12,13,28,40,42,60, 96, 110,)

   a. Lasso — 3.0#/A. active

   b. Vernam — 2.0#/A. active

   c. Lasso + Dyanap — 2+3#/A. active

   d. Lasso + Sencor — 2+0.38#/A. active

5. Yield difference: Treflan vs. — 1,2,12,13,40,42,60,110)

   a. Other dinitroanilines — None

   b. Other herbicides

      1. Lasso + Dyanap — None

      2. Lasso — 5%

      3. Lasso + Sencor — 15%

      4. Vernam — 20%

   c. Cultivation only — 50%

   d. Cultural practices

      1. Change in planting date — Not helpful

      2. Rotations — Not helpful

Soybeans - Region 2

5. d. 2. Expect 10% decrease in soybean acreage. This acreage will go to corn/sorghum

Percent of acres normally treated with Treflan to other herbicides

	Treflan alone (1.6M A.)	Treflan Cominations (900,000 A.)
Lasso + Dyanap	50 (16)*	70 (21)*
Lasso	5 (2)*	5 (2)*
Lasso + Sencor	15 (5)*	10 (3)*
Vernam	10 (3)*	5 (2)*
Cultivation	10 (59)*	5 (52)*
Rotation**	10 (15)*	5 (20)*

*Short term effect
**Rotation shift to corn or sorghum

6. Change in commodity quality — No change (110)

7. Percent of acres treated with alternative that may not receive sufficient rainfall to activate the herbicide after application (110) — 20%

8. Percent of acres treated with alternative herbicides that may not receive first cultivation at the optimal time. (110) — 30%

9. Increase in number of cultivations if alternative herbicides are used. (110) — _____

10. Increase in number of cultivations if no alternative herbicide is used. (1,2,12,13,40,42,60,110) — _____

11. Hand labor if applicable (110) — Excessive cost would prohibit use

Soybeans - Region 2

12. Shifts to other crops (110)

    a. Corn

13. Price of herbicide materials: per gal, lb.,etc.

    a. Treflan $7.50/lb. active

    b. Alternatives

        1. Lasso $4.00/lb. active

        2. Dyanap $2.80/lb. active

        3. Sencor $16.50/lb. active

        4. Vernam $3.00/lb. active

Table 1 Soybeans - Region 2 (1,2,12,13,110)

Alternate treatments to Treflan	Rate/A. in lbs. active	Yield difference as % of Treflan (Base yield - 26 bu./A.)	Percent of acreage to other herbicides: Treflan alone	Percent of acreage to other herbicides: Treflan + others	Cost of material per acre	No. of additional cultivations
Treflan	0.75	100	1.6 M. A.	0.9 M. A.	$5.91	0
Other dinitroanilines		100	-	-	-	0
Alternatives						
1. Lasso + Dyanap	2 + 3	100	50 (16)**	70 (21)	$16.45	0
2. Lasso	3	95	5 (2)	5 (2)	$12.15	1.5
3. Lasso + Sencor	2 + 0.38	85	15 (5)	10 (3)	$14.29	0
4. Vernam	3	80	10 (3)	5 (2)	$5.41	1.3
5.	0	50	10 (59)	5 (52)		2.5
6. Rotation*	-	103	10 (15)	5 (20)	-	-

*Rotation shift to corn or sorghum

**Numbers in ( ) indicates short term effect if sufficient alternatives available to treat only 30% of the acreage.

BIOLOGICAL INFORMATION IN SUPPORT OF ECONOMIC ANALYSIS

SOYBEANS - Region 3

1. Planted acres - 1974-76 ave. — 15,700,000 (120)
2. Yield per acre - 1974-76 ave. — 28 bushels/A. (120)
3. Acres treated with herbicides — 13,100,000 (110)

   Based on 50,000,000 acre 1976 crop

   a. Treflan alone — 3,800,000
   b. Treflan mixed with other herbicides — 1,800,000
   c. Other dinitroanilines — 400,000

4. Alternative herbicides to Treflan (do not consider other dinitroanilines) (1,2,7,8,9,10,11,23,28, 61,62,75,84,85,86,87, 88,93,95,110,123)

   a. Lasso — 2.5#/A. active
   b. Lasso + Sencor — 2 + 0.5#/A. active
   c. Vernam — 3.0#/A. active
   d. Amiben — 3.0#/A. active
   e. Lasso + Lorox — 2 + 0.5#/A. active

5. Yield differnce: Treflan vs. (1,2,6,7,62,110)

   a. Other dinitroanilines — 2%
   b. Other herbicides
      1. Lasso — 2%
      2. Lasso + Sencor — None
      3. Vernam — 6%
      4. Lasso + Lorox — 2%
      5. Amiben — 5%
   c. Cultivation only — 20%

Soybeans - Region 3

5. d. Cultural practices

1. Change in planting date		15%
2. Rotations		15%
6. Change in commodity quality		Slight to none (110)
7. Percent of acres treated with alternative that may not receive sufficient rainfall to activate the herbicide after application		20% (110)
8. Percent of acres treated with alternative herbicide that may not receive first cultivation at the optimal time.		30% (110)
9. Increase in number of cultivations if alternative herbicides are used.		
10. Increase in number of cultivations if no alternative herbicides are used.		
11. Hand labor if applicable	(110)	N/A prohibitive cost
12. Shift to other crops	(110)	
a. Treflan alone acreage		10% to corn*
b. Treflan combination acreage		20% to corn**

*Assuming that only 30% of alternatives are available.
**Assuming that only 40% of alternatives are available.

13. Price of herbicide materials: per gal, lb., etc.		(110)
a. Treflan		$7.50/lb. active
b. Alternatives		
a. Lasso		$4.00/lb. active
b. Sencor		$16.50/lb. active
c. Vernam		$3.00/lb. active
d. Amiben		$5.90/lb. active
e. Lorox		$8.60/lb. active

Table 1 Soybeans - Region 3 (1,2,6,7,110)

Alternate treatments to Treflan	Rate/A. in lbs. active	Yield difference as % of Treflan (Base yield for Treflan alone and Treflan + Sencor = 30 bu./A.)	Percent of acreage to other herbicides		Cost of material per acre	No. of additional cultivations
			Treflan alone	Treflan + others		
Treflan alone	0.75	100	3.8M. A.	1.8M. A.	$5.91	0
Treflan + Sencor	0.75 + 0.5	100	-	-	$14.25	0
Other dinitroanilines		98	-	-	-	0
Alternatives:						
1. Lasso	2.5	98	55 (16)*	0 (0)*	$10.12	1
2. Lasso + Sencor	2.0 + 0.5	100	15 (5)	50 (16)	$16.25	1
3. Vernam	3	94	5 (2)	10 (3)	$8.00	1
4. Amiben	2 + 0.5	95	5 (2)	10 (3)	$17.70	1
5. Lasso + Lorox	2 + 0.5	98	5 (2)	10 (3)	$12.30	1
6. Cultivation only	-	80	5 (43)	0 (35)	-	2
7. Cultural practices						
a) Change planting date	-	15	-	-	-	2
b) Rotations	-	15	-	-	-	2
8. Divert to corn	-	-	10 (30)	20 (40)		

*Number in ( ) indicates short term effect if sufficient alternatives available to treat only 30% of the acreage.

BIOLOGICAL INFORMATION IN SUPPORT OF ECONOMIC ANALYSIS

SOYBEANS - Region 4

1. Planted acres - 1974-76 ave. — 13,900,000 (120)

2. Yield per acre - 1974-76 ave. — 22 bushels/A. (120)

3. Acres treated with herbicides: 1976. — 12,200,000 (110)

   a. Treflan alone — 4,200,000*

   b. Treflan mixed with other herbicides — 2,800,000*

   c. Other dinitroanilines — 700,000*

   *Based on 50,000,000 acre crop in 1976.

4. Alternative herbicides to Treflan (do not consider other dinitroanilines) — (1,2,12,13,47,48,67, 110)

   a. Lasso — 3.0#/A. active

   b. Lasso + Sencor — 3 + 1#/A. active

   c. Sencor — 0.6#/A. active

   d. Vernam — 2.0#/A. active

   e. Lorox — 3.0#/A. active

5. Yield difference: Treflan vs. — (1,2,12,13,47,48,67, 110)

   a. Other dinitroanilines — None

   b. Other herbicides

      1. Lasso + Sencor — 2%

      2. Lasso — 10%

      3. Sencor — 20%

      4. Vernam — 20%

      5. Lorox — 25%

   c. Cultivation only — ____

Soybeans - Region 4

5. d. Cultural practices

   1. Change in planting date — No advantage

   2. Rotations — No advantage

6. Change in commodity quality (110)

   a. Cleaning costs, per unit — 15¢/bushel

   b. Lower grade — ____________

7. Percent of acres treated with alternative that may not receive sufficient rainfall to activate herbicide after application. (110) — 20%

8. Percent of acres treated with alternative herbicides that may not receive first cultivation at the optimal time. (110) — 30%

9. Increase in number of cultivations if alternative herbicides are used. (110) — ____________

10. Increase in number of cultivations if no alternative herbicide is used. — ____________

11. Hand labor if applicable (110) — N/A prohibitive cost

12. Shifts to other crops (110)

   a. Treflan alone acreage - (corn) — 8%*

   b. Treflan combination acreage - (sorghum) — 4%*

   *Assuming only 30% availability of alternative herbicides

13. Price of herbicide materials: per gal., lbs., etc. (110)

   a. Treflan — $7.50/lb. active

   b. Alternatives

      1. Lasso — $4.00/lb. active
      2. Sencor — $16.50/lb. active
      3. Vernam — $3.00/lb. active
      4. Lorox — $8.60/lb. active

Table 1 Soybeans - Region 4 (1,2,12,13,110)

Alternate treatments to Treflan	Rate/A. in lbs. active	Yield difference as % of Treflan (Base yield - 28 bu./A.)	Percent of acreage to other herbicides		Cost of material per acre	No. of additional cultivations
			Treflan alone	Treflan + others		
Treflan	0.75	100	4.2 M. A.	2.8 M. A.	$5.91	0
Treflan + Sencor	0.75 + 0.6	100	-	-	$15.81	0
Other dinitroanilines		100	-	-		
Alternatives						
1. Lasso + Sencor	3 + 1	98	17 (5)*	18 (5)*	$20.15	0.9
2. Lasso	3	90	35 (11)	15 (5)	$12.15	1.9
3. Sencor	0.6	80	9 (3)	12 (4)	$9.90	2.4
4. Vernam	2.0	80	7 (2)	30 (10)	$5.41	2.4
5. Lorox	3.0	75	5 (2)	6 (2)	$12.90	2.4
6. Cultivation	-	45	20 (41)	15 (34)	-	3.8
7. Cultivation + Hoeing	-	98	0	0	-	1.8
8. Rotation w/other crops	-	115	8 (18)	4 (20)	-	1.8

*Numbers in ( ) indicates short term effect if sufficient alternatives available to treat only 30% of the acreage

BIOLOGICAL INFORMATION IN SUPPORT OF ECONOMIC ANALYSIS

SOYBEANS - Region 5

1. Planted acres - 1974-76 ave. 17,700,000 (120)
2. Yield per acre - 1974-76 ave. 25.4 bushels (120)
3. Acres treated with herbicides - 1976 14,500,000 (110)

   Based on 50,000,000 acre 1976 crop

   a. Treflan alone 4,200,000
   b. Treflan mixed with other herbicides 400,000
   c. Other dinitroanilines 100,000

4. Alternative herbicides to Treflan (do not consider other dinitroanilines) (110)

   a. Lasso + Sencor 2.0 + 0.5#/A. active
   b. Lasso 3.0#/A. active
   c. Amiben 3.0#/A. active
   d. Vernam 3.0#/A. active

5. Yield difference: Treflan vs. (1,2,5,6,7,23,32,84,85,8 87,88,110)

   a. Other dinitroanilines 5%
   b. Other herbicides
      1. Lasso + Sencor 15%
      2. Lasso 18%
      3. Amiben 18%
      4. Vernam 10%
   d. Cultivation only 30%
   e. Cultural practices
      1. Change planting date 40%
      2. Rotations ______

Soybeans - Region 5

6. Change in commodity quality (110)

   a. Dockage percentage — 1% loss

   b. Cleaning costs, per unit — 10¢/bushels

7. Percent of acres treated with alternative that may not receive sufficient rainfall to activate the herbicide after application (110) — 25%

8. Percent of acres treated with alternative herbicides that may not receive first cultivation at the optimal time. (110) — 30%

9. Increase in number of cultivations if alternative herbicides are used. (1,2,5,6,7,110) ____________

10. Increase in number of cultivations if no alternative herbicide is used. (1,2,5,6,7,110) ____________

11. Hand labor if applicable (110) — Not applicable

12. Shifts to other crops (110) — None

13. Price of herbicide materials: per gal, lb., etc. (110)

    a. Treflan — $7.50/lb. active

    b. Alternatives

       1. Lasso — $4.00/lb. active

       2. Sencor — $16.50/lb. active

       3. Vernam — $3.00/lb. active

       4. Amiben — $5.90/lb. active

Table 1 Soybeans - Region 5 (1,2,5,6,7,110)

Alternate treatments to Treflan	Rate/A. in lbs. active	Yield difference as % of Treflan (Base yield - 28 bu./A.)	Percent of acreage to other herbicides		Cost of material per acre	No. of additional cultivations
			Treflan alone	Treflan + others		
Treflan alone	0.75	100	4.2 M. A.	0.4 M. A.	$.5.91	0
Treflan + Sencor*	0.75 + 0.5	100	-	-	$14.25	0
Other dinitroanilines	Variable	95	-	-	variable	0
Alternatives						
1. Lasso + Sencor	2 + 0.5	85	50 (15)**	48 (14)**	$16.25	1
2. Lasso	3	82	13 (4)	5 (2)	$12.00	1
3. Vernam	3	90	18 (5)	40 (12)	$8.00	1
4. Amiben	3	82	13 (4)	5 (2)	$17.70	1
5. Cultivation	-	70	2 (4)	35 -		
6. Cultural practices						
a. change planting date	-	60	2 (5)	10 (10)		
b. Rotation-Shift to corn	-	-	2 (20)	25 -		

* Sencor considered representative of several herbicides such as Lorox, Dyanap, etc., which are used in in combinations. Rate and cost per acre would be somewhat different, but not to a large degree.

**Numbers in ( ) indicate short term effect if sufficient alternatives available to treat only 30% of acreage.

BIOLOGICAL INFORMATION IN SUPPORT OF ECONOMIC ANALYSIS

SUGAR BEETS - U.S.

1. Planted acres. 1973-75 average — 1,374,133 (120)
2. Yield per acre. 1973-75 (For Calif.) — 18 tons/A. (120)
3. Acres treated with herbicides: 1975-76 — 1,345,000 (110)

   98% of planted acreage treated

   a. Treflan alone — None

   b. Treflan and other herbicides — 264,880 acres

   40% of Calif., Colorado, and Idaho acreage (662,200 acres)

   c. Other dinitroanilines — None

4. Alternative herbicides to Treflan (do not consider other dinitroanilines). (1,2,3,4,5,6,7,14,15,110)

   a. Eptam — 2.5#/A. active — 264,880 acres

   100% of Treflan acreage

5. Yield difference: Treflan vs. (110)

   Other dinitroanilines -

   b. Other Herbicides - No change with one hand weeding.

   c. Cultivation only

   d. Cultural practices

   1. Change planting date — None
   2. Rotations — No

6. Change in commodity quality — None (110)
7. Percent of acres treated with alternative that may not receive sufficient rainfall to activate the herbicide — None (110)
8. Percent of acres treated with alternatives herbicides that may not receive first cultivation at the optimal time. — None (110)
9. Increase in number of cultivations if alternative herbicides are used. — 2 additional (110)

   Eptam plus 2 cultivations on 264,880 acres. Cost $5.00 for each cultivation

10. Increase in number of cultivations if no alternative herbicide is used — None (110)
11. Hand labor if applicable (110)

   a. Number of acres — 264,880

b. Cost per acre per season

12 hrs. labor at $2.75/hr. $33.00/A.

12. Shifts to other crops None (110)

13. Price of herbicide materials: per gal., lb., etc. (110)

a. Treflan 7.50/lb. active

b. Alternatives

1. Eptam 3.00/lb. active

BIOLOGICAL INFORMATION IN SUPPORT OF ECONOMIC ANALYSIS

SUNFLOWERS - U.S.

1. Planted acres - 1974-76 — 1,000,000 (120)
2. Yield per acre - 1974-76 — 1,050 lbs. (120)
3. Acres treated with herbicides: 1975-1976 70 percent of planted acreage — 700,000 (110)
   a. Treflan alone. 65% of planted acreage plus 1 cultivation — 650,000
   b. Treflan mixed with other herbicides — None
   c. Other dinitroanilines - 5% — 50,000
4. Alternative herbicides to Treflan (do not consider other dinitroanilines (1,2,5,6,7, 28,110)
   a. Eptam — 3#/A. active — 325,000 each
   b. Amiben — 3#/A. active
5. Yield difference: Treflan vs. (1,2,5,6,7,110)
   a. Other dinitroanilines — None
   b. Other herbicides:
      1. Eptam — 5% loss in yield
      2. Amiben — 10% loss in yield
6. Change in commodity quality — None (110)
7. Percent of acres treated with alternative that may not receive sufficient rainfall to activate the chemical after application (110)
   a. Amiben — 15%
   b. Eptam — 5%
8. Percent of acreage treated with alternative herbicides that may not receive first cultivation at optimal time (110)
   a. Amiben — 20%
   b. Eptam — 10%

9. Increase in number of cultivations if alternative herbicides are used — 1 additional (1,2,5, 6,7,110)

10. Increase in number of cultivations if no alternative herbicide is used (1,2,5,6,110) — 2 additional over # 9 above

11. Hand labor if applicable — Not applicable (110)

    Growers could not obtain hand labor or afford to use it. With only cultivation, the weed problem in the sunflower row would be very competitive, particularly early in the season.

12. Shifts to other crops — Not expected (110)

13. Price of herbicide materials: per gal., lb., etc. (110)

    a. Treflan — $7.50/lb. active

    b. Amiben — 5.90/lb. active

    c. Eptam — 3.00/lb. active

BIOLOGICAL INFORMATION IN SUPPORT OF ECONOMIC ANALYSIS

TREE FRUITS AND NUTS - California (excluding citrus, grapes and apples)

1. Planted acres - 1974-76 ave. — 1,300,000 (110)
2. Gross value — $1,000/A.
3. Acres treated with herbicides: 1975-76 — 585,000 (110)
   45% of planted acreage
   a. Treflan alone — None
   b. Treflan and other herbicides — 30,000
      5% along with Simazine and Devrinol
   c. Other dinitroanilines - 5% (Surflan) — 30,000
4. Alternative herbicides to Treflan (do not consider other dinitroanilines) (1,2,3,14,15,17,28,110)
   a. Casoron — 5 lbs./A.
5. Yield difference: Treflan vs. (1,2,3,14,15,17,110)
   a. Other dinitroanilines — None
   b. Other herbicides
      1. Casoron — None
   c. Cultivation only - 15% - due to damage to surface root system
   d. Cultural Practices — No changes
6. Changes in commodity quality (110) —
7. Percent of acres treated with (110) alternative that may not receive sufficient rainfall to activate herbicide after application — None
8. Percent of acres treated with alternative herbicides that may not receive first cultivation at the optimal time — None (110)
9. Increase in number of cultivations if alternative herbicides are used — (110)
10. Increase in number of cultivations if no alternative herbicide is used — 3 additional (1,2,3,14,15,110)
    $5.00 per cultivation/A.
11. Hand labor if applicable (110)
    a. Number of acres —
    b. Cost per acre per season
       If Casoron used, no hand labor needed

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12. Shifts to other crops — No shifts (110)

13. Price of herbicide materials: per gal., lb., etc. (110)

    a. Treflan — $7.88/lb. active

    b. Alternatives

        1. Casoron — 10.50/lb. active

For weed control in fruit and nut trees and in prunes, the use of Treflan for bindweed control by layering or incorporated treatments and incorporated treatments for Bermudagrass and Johnsongrass control is finding ready acceptance. The dinitroaniline group represents the most economical and effective materials available for the present and forseeable future.

BIOLOGICAL INFORMATION IN SUPPORT OF
ECONOMIC ANALYSIS

BROCCOLI (FRESH & PROCESSING) - U.S.

1. Planted acres - 1974-76 ave. 51,117 (120)

2. Yield per acre - 1974-76 ave. 3.9 Tons/A. (120)

3. Acres treated with herbicides: 1975-76 ave. 40,894 (110)

   80% of planted acres treated

   a. Treflan alone at 0.5 lb./A. 33,226

   b. Treflan mixed with other herbicides None

   c. Other dinitroaniline None

4. Alternative herbicides to Treflan (do not consider other dinitroanilines) (1,2,14,15,28,110)

   a. TOK $\frac{\text{33,226 acres}}{\text{100\%}}$ 4 lbs./A./active

5. Yield difference: Treflan vs. (1,2,14,15,28,110)

   a. Other dinitroaniline None

   b. Other herbicides None

   c. Cultivation only

   d. Cultural practices No Change

6. Change in commodity quality None (110)

7. Percent of acres treated with alternative that may not receive sufficient rainfall to activate herbicide after application None (110)

8. Percent of acreage treated with alternative herbicides that may not receive first cultivation at the optimal time None (110)

9. Increase in number of cultivations if alternative herbicides are used 33,226 acres 2 additional (110)

10. Increase in number of cultivations if no alternative herbicide is used 4 additional (110)

11. Hand labor if applicable. (110)

    a. Number of acres treated with alternate 33,226

    b. Cost per acre per season 5 hrs/A. at $2.60/hr

12. Shifts to other crops None (110)

13. Price of herbicide materials: per gal, lb., etc. (110)

    a. Treflan $7.88/lb./active

    b. Alternatives

        1. TOK $5.60/lb./active

BIOLOGICAL INFORMATION IN SUPPORT OF ECONOMIC ANALYSIS

BRUSSEL SPROUTS - U.S.

1. Planted acres - 1974-76 ave. 5,600 (120)
2. Yield per acre - 1974-76 ave. 5.6 T/A. (120)
3. Acres treated with herbicides: 1975-76 ave. 4,480 acres (110)

   80% of acres treated.

   a. Treflan alone at 0.75 lb./Acre active 3,640
   b. Treflan mixed with other herbicides None
   c. Other dinitroaniline None
4. Alternative herbicides to Treflan (do not consider other dinitroanilines) (1,2,14,15,110)
   a. TOK 3,640 acres / 100% 4 lbs/A./active
5. Yield difference: Treflan vs. (1,2,14,15,110)
   a. Other dinitroaniline None
   b. Other herbicides None
   c. Cultivation only
   d. Cultural practices No change
6. Change in commodity quality None (110)
7. Percent of acres treated with alternative that may not receive sufficient rainfall to activate herbicide after application (110) None
8. Percent of acreage treated with alternative herbicides that may not receive first cultivation at the optimal time (110) None
9. Increase in number of cultivations if alternative herbicides are used (110) 2 additional
10. Increase in number of cultivations if no alternative is used (110) 4 additional

11. Hand labor if applicable (110)

    a. Number of acres treated with alternate — 3,640 acres

    b. Cost per acre per season — 5 hrs/A. at $2.60/hr

12. Shifts to other crops — None (110)

13. Price of herbicide materials: per gal, lb., etc. (110)

    a. Treflan — $7.88/lb./active

    b. Alternatives

        1. TOK — $5.60/lb./active

BIOLOGICAL INFORMATION IN SUPPORT OF
ECONOMIC ANALYSIS

CABBAGE (FRESH & PROCESSING) - U.S.

1.	Planted acres - 1974-76 ave.	110,250	(120)
2.	Yield per acre - 1974-76 ave.	11.9 T/A	(120)
3.	Acres treated with herbicides: 1975-76 ave.	102,533	(110)
	93% of acreage treated		
	a. Treflan alone at use rate of 0.75#/A.active	73,268	
	b. Treflan mixed with other herbicides	None	
	c. Other dinitroaniline	None	
4.	Alternative herbicides to Treflan (do not consider other dinitroanilines)	(1,2,12,13,14,15,26, 28,30,110, 111,115)	
	a. TOK - has pre and post activity — 73,268 / 100%	5#/A. active	
5.	Yield differnce: Treflan vs.	(1,2,12,13,14,15,110)	
	a. Other dinitroaniline	None	
	b. Other herbicides	None	
	c. Cultivation only		
	d. Cultural practices	No change	
6.	Change in commodity quality	None	(110)
7.	Percent of acres treated with alternative that may not receive sufficient rainfall to activate herbicide after application	None	(110)
8.	Percent of acreage treated with alternative herbicides that may not receive first cultivation at the optimal time	None	(110)
9.	Increase in number of cultivations if alternative herbicides are used on 73,268 acres	2 additional	(110)
10.	Increase in number of cultivations if no alternative herbicide is used.	4 additional	(110)

11. Hand labor if applicable (110)

    a. Number of acres treated with alternate 73,268

    b. Cost per acre per season 4 hrs/A at $2.60/hr

12. Shifts to other crops None (110)

13. Price of herbicide materials: per gal, lb., etc. (110)

    a. Treflan $7.88 lb/active

    b. Alternatives

        1. TOK W.P. $5.60/lb./active

BIOLOGICAL INFORMATION IN SUPPORT OF
ECONOMIC ANALYSIS

CANTALOUPES including HONEYDEWS (REGISTERED IN WEST ONLY)

1. Planted acres - 1974-76 ave.	88,540	(120)
2. Yield per acre - 1974-76 ave.	7.4 T/A.	(120)
3. Acres treated with herbicides: 1975-76 ave.	70,832	(110)
a. Treflan alone at 0.75 lb./A.	55,950	
b. Treflan mixed with other herbicides	None	
c. Other dinitroaniline	None	
4. Alternative herbicides to Treflan (do not consider other dinitroanilines)		(1,2,6,7,12,13,14,15, 21,26,28,102, 110)
a. Prefar 5# + Alanap 2#/A. as preplant incorporated mixture.	55,950 acres 100%	
5. Yield difference: Treflan vs.		(1,2,6,7,12,13,14,15,110)
a. Other dinitroaniline	None	
b. Other herbicides	None	
c. Cultivation only		
d. Cultural practices	No Change	
6. Change in commodity quality	None	(110)
7. Percent of acres treated with alternative that may not receive sufficient rainfall to activate herbicide after application	None	(110)
8. Percent of acreage treated with alternative herbicides that may not receive first cultivation at the optimal time	None	(110)
9. Increase in number of cultivations if alternative herbicides are used.	None	(110)
10. Increase in number of cultvations if no alternative herbicide is used.	1 additional	(110)

11. Hand labor if applicable (110)

    a. Number of acres of alternate 55,950

    b. Cost per acre per season $7.00

       3 hrs/A. @ $2.60 per hour

12. Shifts to other crops No shifts (110)

13. Price of herbicide materials: per gal, lb., etc. (110)

    a. Treflan $7.88/lb./active

    b. Alternatives

       1. Prefar $4.11/lb./active

       2. Alanap $4.20/lb./active

BIOLOGICAL INFORMATION IN SUPPORT OF
ECONOMIC ANALYSIS

CARROTS (FRESH & PROCESSING) - U.S.

1. Planted acres - 1974-76 ave. 78,137 (120)

2. Yield per acre - 1974-76 ave. 6.8 Tons/A. (120)

3. Acres treated with herbicides: 1975-76 ave. 75,594 (110)

    a. Treflan alone at 3/4 lb/A. 31,526

    b. Treflan mixed with other herbicides None

    c. Other dinitroaniline None

4. Alternative herbicides to Treflan (do not consider other dinitroanilines) (1,2,6,7,12,13,110)

    31,526

    a. TOK Preemergence at 4# and Lorox Late post at 1#/A. 50%

    b. Oil 40 gal/A. early post and Lorox 1#/A. late post. 50%

5. Yield difference: Treflan vs. (1,2,6,7,12,13,14,21,26,30,

    a. Other dinitroaniline None

    b. Other herbicides None

    c. Cultivation only

    d. Cultural practices No change

6. Change in commodity quality None (110)

7. Percent of acres treated with alternative that may not receive sufficient rainfall to activate herbicide after application (110) None

8. Percent of acreage treated with alternative herbicides that may not receive first cultivation at the optimal time (110) None

9. Increase in number of cultivations if alternative herbicides are used (1,2,6,7,12,13,14,15,110 None

10. Increase in number of cultivations if no alternative herbicide is used (31,526) (1,2,6,7,12,13,14,15,11 2 additional

11. Hand labor if applicable (110)

    a. Number of acres if alternative herbicides used 31,526

    b. Cost per acre per season 5 hrs/A. at $2.60/A.

12. Shifts to other crops None (110)

13. Price of herbicide materials: per gal, lb., etc. (110)

    a. Treflan $7.88/lb./active

    b. Alternatives

        1. Lorox $8.60/lb./active

        2. Oil $ .75/gal

        3. TOK $5.60/lb./active

BIOLOGICAL INFORMATION IN SUPPORT OF ECONOMIC ANALYSIS

CAULIFLOWER (FRESH & PROCESSING) - U.S.

1. Planted acres - 1974-76 ave. — 33,233 (120)
2. Yield per acre - 1974-76 ave. — 5.0 Tons/A. (120)
3. Acres treated with herbicides: 1975-76 ave. — 21,130 (110)
   a. Treflan alone at ½ lb./A. active — 18,147
   b. Treflan mixed with other herbicides — None
   c. Other dinitroaniline — None
4. Alternative herbicides to Treflan (don't consider other dinitroanilines) (1,14,15,26,110)
   a. TOK $\frac{18,147}{100\%}$ — 4 lb/A./active
5. Yield differnce: Treflan vs. (1,14,15,110)
   a. Other dinitroaniline — None
   b. Other herbicides — None
   c. Cultivation only — ______
   d. Cultural practices — No Change
6. Change in Commodity quality — None (110)
7. Percent of acres treated with alternative that may not receive sufficient rainfall to activate herbicide after application — None (110)
8. Percent of acreage treated with alternative herbicides that may not receive first cultivation at the optimal time — None (110)
9. Increase in number of cultivations if alternative herbicides are used — 2 additional (110)
10. Increase in number of cultivations if no alternative herbicides are used — 4 additional (1,14,15,110)

11. Hand labor if applicable

 a. Number of acres treated with alternate — 18,147 (110)

 b. Cost per acre per season — 5 hrs/A. at $2.60/hr

12. Shifts to other crops — None (110)

13. Price of herbicide materials per gal, lb, etc. (110)

 a. Treflan — $7.88/lb/active

 b. Alternatives

  1. TOK W.P. — $5.60/lb/active

BIOLOGICAL INFORMATION IN SUPPORT OF
ECONOMIC ANALYSIS

CELERY (FRESH & PROCESSING) - U.S.

1.	Planted acres - 1974-76 ave.	34,263	(120)
2.	Yield per acre - 1974-76 ave.	25.1 T/A.	(120)
3.	Acres treated with herbicides: 1975-76 ave.	27,410	(110)
	a. Treflan alone 0.75/Acre active	13,510	
	b. Trfelan mixed with other herbicides	None	
	c. Other dinitoraniline	None	
4.	Alternative herbicides to Treflan (don't consider other dinitroanilines)		(110)
	a. TOK $\frac{\text{13,510 acres}}{\text{100 \%}}$	4 lb.	
5.	Yield difference: Treflan vs.		(1,12,13,14,15,110)
	a. Other dinitroaniline	None	
	b. Other herbicides	None	
	c. Cultivation only		
	d. Cultural practices	None	
6.	Change in commodity quality	None	(110)
7.	Percent of acres treated with alternative that may not receive sufficient rainfall to activate herbicide after application	None	(110)
8.	Percent of acreage treated with alternative herbicides that may not receive first cultivation at the optimal time	None	(110)
9.	Increase in number of cultivations if alternative herbicides are used.	None	(110)
10.	Increase in number of cultivations if no alternative herbicide is used.	None	(110)

11. Hand labor if applicable (110)

    a. Number of acres if alternate used 13,510

    b. Cost per acre per season 4 hrs labor @ $2.60/hr

12. Shifts to other crops None (110)

13. Price of herbicide materials: per gal, lb., etc. (110)

    a. Treflan $7.88/lb./active

    b. Alternatives

        1. TOK W.P. $5.60/lb./active

BIOLOGICAL INFORMATION IN SUPPORT OF
ECONOMIC ANALYSIS

COLLARDS & OKRA (GEORGIA ONLY - MAIN U.S. SUPPLY)

1. Planted acres - 1976 ave. 10,500 (110)

2. Yield per acre - 1074-76 ave. (110)

3. Acres treated with herbicides: 1975-76 ave. 9,975 (110)

   95% of acres treated.

   a. Treflan alone 9,450

      90% of planted acres

   b. Treflan mixed with other dinitroaniline None

   c. Other dinitroaniline

4. Alternative herbicides to Treflan (do not consider other dinitroanilines)

   None Registered

5. Yield difference: Treflan vs. (110)

   a. Other dinitroaniline None

   b. Other herbicides

   c. Cultivation only

   d. Cultural practice No Change

6. Change in commodity quality None (110)

7. Percent of acres treated with alternative that may not receive sufficient rainfall to activate herbicide after application None (110)

8. Percent of acreage treated with alternative herbicides that may not receive first cultivation at the optimal time None (110)

9. Increase in number of cultivations if alternative herbicides are used N/A (110)

10. Increase in number of cultivations if no alternative herbicide is used 9,450 acres 3 additional (110)

11. Hand labor if applicable (110)

    a. Number of acres of no alternate 9,450

    b. Cost per acre per season $104.00

       40 hrs/A. $2.60/hr

12. Shifts to other crops None (110)

13. Price of herbicide material: per gal, lb., etc. (110)

    a. Treflan $7.88/lb.

    b. Alternatives: None

BIOLOGICAL INFORMATION IN SUPPORT OF

ECONOMIC ANALYSIS

<u>CUCUMBERS</u> - U. S. (Fresh and processed)

1. Planted acres - 1974-76 ave — 193,282 (120)
   a. Processed — 141,632
   b. Fresh — 51,650
2. Yield per acre - 1974-76 ave. — 5 tons (120)
3. Acres treated with herbicides: 1975-76 ave. — 173,954 (110)
   a. Treflan alone 0.75 lb/A. — 4,130

      Treflan registered only in Texas and West. Used alone only in Calif.
   b. Treflan mixed with other herbicides — None
   c. Other dinitroanilines — None
4. Alternative herbicides to Treflan (do not consider other dinitroanilines) — (1,6,7,12,13,14,15,21, 28,30,35,46,92,102, 106,110,115)
   a. <u>Prefar 5 lbs. + Alanap 2 lbs./A.</u>

      <u>as preplant incorporated</u>
5. Yield difference: Treflan vs. — 1,6,7,12,13,14,15,110)
   a. Other dinitroanilines — ______
   b. Other herbicides — ______
   c. Cultivation only — ______
   d. Cultural practices — No change
6. Change in commodity quality — ______ (110)
7. Percent of acres treated with alternatives that may not receive sufficient rainfall to activate the material after application — None (110)
8. Percent of acres treated with alternative herbicide that may not receive first cultivation at the optimal time after planting — None (110)
9. Increase in number of cultivations if alternative herbicides are used — ______ (110)

10. Increase in number of cultivations if no alternative herbicide is used	1 additional (110)
11. Hand labor if applicable	(110)
a. Number of acres	4,130
b. Cost per acre per season	$7.80
3 hrs/A. at $2.60/hr.	
12. Shifts to other crops	No shifts (110)
13. Cost of herbicide materials: per gal., lb., etc.	(110)
a. Treflan	7.88/lb. active
b. Alternatives	
1. Prefar	4.11/lb. active
2. Alanap	4.20/lb. active

BIOLOGICAL INFORMATION IN SUPPORT OF ECONOMIC ANALYSIS

DRY BEANS - U.S.

1. Planted acres. 1973-75 average — 1,515,000 (120)

2. Yield per acre. 1974-76 average — 18 hundred-weight (120)

3. Acres treated with herbicides: 1974-76 — 1,363,590 (110)

   a. Treflan alone. 3% — 40,900

   b. Treflan mixed with other herbicides. 85% — 1,159,000

   c. Other dinitroanilines 5% — 68,180

   The acreage treated will vary by state or region. The above percentages represent an average for U.S.

4. Alternative herbicides to Treflan (do not consider other dinitroanilines). (1, 6,7,14,15,16,18,22,28,38,39, 91,106,110,114)

   a. Eptam — 3 lbs./A. active

   b. Lasso — 2.5 lbs./A. active

   c. Amiben — 2.0 lbs./A. active

   d. Dinitro — 8 lbs./A. active

   The use of alternative herbicides will result in increased broadleaved and grass problems. This will vary with state or region, but the species of weeds include: pigweed, nightshade, and a range of annual grasses.

5. Yield difference: Treflan vs. 1,6,7,14,15,16,18,22,38,39,91,110)

   a. Other dinitroanilines — None

   b. Other herbicides — 7% average loss

   Yield loss will vary from 0 to 15%, depending on weed species, soils, climatic conditions, etc.

   c. Cultivation only — ______

   d. Cultural practices (See # 9) — ______

   Without Treflan and where nightshade is a problem, growers would have serious production problems in 3-5 years and would be forced to change crops, [illegible] planted to beans or go out of production

6. Change in commodity quality (110)

With alternatives, the residual weed control activity is shorter and growers will lose late season broadleaved and grass control. Treflan is particularly effective on the grass species. In some areas, this increased weed problem will impede harvest, increase drying time due to the added moisture in the windrow, and will result in mold development and a loss of quality. In Idaho, for example, this will drop quality from #1 to #2 and a loss to growers of $2.00 per hundredweight. There will also be up to 20% loss due to shattering while the beans are drying in the windrow.

7. Percent of acres treated with alternative that may not receive sufficient rainfall to activate the material after application.

On a state or regional basis, this could run as high as 60%. The shallow incorporation of alternatives such as Lasso would reduce the impact of inadequate rainfall for activation.

8. Percent of acres treated with alternative herbicides that may not receive first cultivation at the optimal time

9. Increase in number of cultivations if alternative herbicides are used. None (110)

The growers normally cultivate 3 times and where alternative materials were available, the number of cultivations would not increase. This is not to say, however, that comparable weed control would be obtained. The impact on yield, quality, and costs of hand labor would vary on a regional basis, but could be severe.

10. Increase in number of cultivations if no alternative herbicide is used See # 9 (110)

11. Hand labor if applicable (110)

a. Number of acres 1,199,000

b. Cost per acre per season $50

The use of hand labor will vary on a local basis. There will be need on all of the dry bean acreage which normally received Treflan. The extent of use will depend on the availability of hand labor, the seriousness of the weed problem, and the individual grower. A reasonable average estimate is that [illegible]% of the acreage will require hand weeding, at a cost of $[illegible] per acre.

12. Shifts to other crops (110) No change in short term

13. Price of herbicide materials: per gal., lb., etc. (110)

    a. Treflan — $7.88/lb. active

    b. Alternatives

        1. Eptam — 3.00/lb. active
        2. Lasso — 4.00/lb. active
        3. Amiben — 5.75/lb. active
        4. Dinitro — 2.48/lb. active

BIOLOGICAL INFORMATION IN SUPPORT OF ECONOMIC ANALYSIS

LIMA BEANS (PROCESSING) - U.S.

1. Planted acres - 1974-76 ave. — 72,267 (120)

2. Yield per acre - 1974-76 ave. — 1.2 T/A. (120)

3. Acres treated with herbicides: 1975-76 ave. — 71,057 (110)

   a. Treflan alone at 0.6 lbs/A. — 65,290

   b. Treflan mixed with other herbicides — None

   c. Other dinitroaniline — None

4. Alternative herbicides to Treflan (do not consider other dinitroanilines) (1,6,7,14,15,18,30,103,110, 115).

	65,290 acres	
a. Amiben (Calif.)	20.5%	2#/Acre
b. Amiben (other)	79.5%	4#/Acre

5. Yield difference: Treflan vs. (1,6,7,14,15, 110)

   a. Other dinitroaniline — None

   b. Other herbicides — None

   c. Cultivation only —

   d. Cultural practices — No change

6. Change in commodity quality — None (110)

7. Percent of acres treated with alternative that may not receive sufficient rainfall to activate herbicide after application — 20% (110)

8. Percent of acreage treated with alternative herbicides that amy not receive first cultivation at the optimal time — 10% (110)

9. Increase in number of cultivations if alternative herbicides are used. (110)

   a. California - on 13,390 acres — 1 additional

   b. other - on 51,900 acres — 2 additional

10. Increase in number of cultivations if no alternative herbicide is used. (110)

    a. California - on 13,390 acres — 2 additional

    b. Other - on 51,900 acres — 3 additional

11. Hand labor if applicable (110)

    a. Number of acres if alternate used — 65,290

    b. Cost per acre per season — 4 hrs/A. @ $2.75/hr

12. Shifts to other crops — None (110)

13. Price of herbicide materials: per gal, lb., etc. (110)

    a. Treflan — $7.88/lb./active

    b. Alternatives

       1. Amiben — $5.75/lb./active

BIOLOGICAL INFORMATION IN SUPPORT OF
ECONOMIC ANALYSIS

PEAS - PROCESSING - U.S. (120)

1. Planted acres - 1974-76 ave. 438,700

2. Yield per acre - 1974-76 ave. 1.3 Tons/A.(120)

3. Acres treated with herbicides: 1975-76 ave. 350,960 (110)

   80% of planted acres treated

   a. Treflan alone at .6 lbs./A. 131,610

      30% of planted acres treated

   b. Treflan mixed with other herbicides None

   c. Other dinitroaniline None

      Wisconsin (Grower estimates):

Help from herbicides savings/acre	$23.00
Harvesting ease - money saved	16.00
Quality improvement	29.00
Saved with use of herbicides	$68.00

4. Alternative herbicides to Treflan (do not consider other dinitroanilines) (1,6,7,14,15,30,36,58, 92,101,103,110)

   a. Dalapon (Wisconsin & Minnesota) 58,620 / 100% 1#/A. active

5. Yield difference: Treflan vs. (1,6,7,14,15,110)

   a. Other dinitroaniline

   b. Other herbicides:

      1. Dalapon for 58,620 acres 20% reduction in yield

      Oregon and Washington:
      No alternative herbicide on 72,990, therefore, reduce yield 40%

   c. Cultivation only

   d. Cultural practices None

6. Change in commodity quality (110)

   If lost Treflan, and had no other herbicide

in Wisconisn and Minnesota, growers could lose $45/A. due to lower quality and additional cost of harvest on 58,620 acres.

a. Dockage percentage ____________

b. Cleaning costs, per unit ____________

c. Lower grade ____________

7. Percent of acres treated with alternative herbicides that may not receive sufficient rainfall to activate chemical after application. ____________

8. Percent of acres treated with alternative herbicide that may not receive first cultivation at the optimal time. ____________

9. Increase in number of cultivations, if alternative herbicides are used. ____________

   Solid Stand - No cultivation

10. Increase in number of cultivations if no alternative herbicide is used. ____________

11. Hand labor if applicable. (110)

    a. Number of acres None

    b. Cost per acre per season None

12. Shifts to other crops None

13. Price of herbicide materials: per gal., lbs., etc. (110)

    a. Treflan $7.88/lb./active

    b. Alternatives

       1. Dalapon $2.00/lb./active

BIOLOGICAL INFORMATION IN SUPPORT OF
ECONOMIC ANALYSIS

PEPPERS (FRESH & PROCESSING) - U.S.

1. Planted acres - 1974-76 ave. 54,020 (120)

2. Yield per acre - 1974-76 ave. 5.1 T/A. (120)

3. Acres treated with herbicices: 1975-76 ave. 29,136 (110)

   a. Treflan alone 3/4 lb. per acre 20,395

   b. Treflan mixed with other herbicides None

   c. Other dinitroaniline None

4. Alternative herbicides to Treflan (do not consider other dinitroanilines) (1,6,7,12,13,14,15,21, 28,34,110)

   20,395 acres

   a. Enide (preplant) 4#/A. 20%

   b. Devrinol (preplant) 1#/A. 80%

5. Yield differnce: Treflan vs.

   a. Other dinitroaniline None

   b. Other herbicides None

   c. Cultivation only

   d. Cultural practices None

6. Change in commodity quality None (110)

7. Percent of acres treated with alternative that may not receive sufficient rainfall to activate herbicide after application None (110)

8. Percent of acreage treated with alternative herbicides that may not receive first cultivation at the optimal time None (110)

9. Increase in number of cultivations if alternative herbicides are used None (110)

10. Increase in number of cultivations if no alternative herbicide is used. 2 additional (110)

-5

11. Hand labor if applicable (110)

    a. Number of acres of alternate used: 20,395

    b. Cost per acre per season: 20 hrs/A. of labor x $2.60/hr

12. Shifts to other crops: None (110)

13. Price of herbicide materials: per gal, lb., etc. (110)

    a. Treflan: $7.88/lb./active

    b. Alternatives

        1. Enide: $6.00/lb./active

        2. Devrinol: $8.00/lb./active

BIOLOGICAL INFORMATION IN SUPPORT OF
ECONOMIC ANALYSIS

POTATOES - U.S.

1. Planted acres 1973-75 ave. — 1,349,433 (120)

2. Yield per acre - 1973-75 ave. — 12.1 Tons/A. (120)

3. Acres treated with herbicides: 1975 ave. — 956,000 (110)

   a. Treflan alone 0.75 lb./Acre — 45,000

   b. Treflan mixed with other herbicides — 27,000

      Treflan ½ lb + Eptam 3 lbs/A.

   c. Other dinitroaniline — None

4. Alternative herbicides to Treflan (do not consider other dinitroanilines) (1,12,13,14,15, 28, 50,108,110)

	45,000	27,000	
a. Eptam	50%	50%	4#/A./active
b. Lorox	30%	30%	1.5#/A./active
c. Premerge	20%	20%	4.5#/A./active

5. Yield difference: Treflan vs. (1,12,13,14,15,110)

   a. Other dinitroaniline — None

   b. Other herbicides — None

   c. Cultivation only —

   d. Cultural practices — No change

6. Change in commodity quality — None (110)

7. Percent of acres treated with alternative that may not receive sufficient rainfall to activate herbicide after application — None (110)

8. Percent of acreage treated with alternative herbicides that may not receive first cultivation at the optimal time — None (110)

9. Increase in number of cultivations if alternative herbicides are used on 72,000 acres — 1 additional (110)

10. Increase in number of cultivations if no alternative is used on 72,000 acres — 2 additional (110)

11. Hand labor if applicable (110)

    a. Number of acres — None

    b. Cost per acre per season — None

12. Shifts to other crops — No shifts (110)

13. Price of herbicide materials: per gal, lb., etc. (110)

    a. Treflan — $7.88/lb./active

    b. Alternatives

        1. Eptam — $3.00/lb./active

        2. Lorox — $8.60/lb./active

        3. Premerge — $2.48/lb./active

BIOLOGICAL INFORMATION IN SUPPORT OF

ECONOMIC ANALYSIS

SNAPBEANS - U. S.

1. Planted acres - 1974-76 ave. — 379,203 (120)
   - a. For processing — 289,823
   - b. Fresh market — 89,380
2. Yield per acre - 1974-76 ave. — (120)
   - a. For processing — 2.49 tons/A.
   - b. Fresh Market — 1.82 tons/A.
3. Acres treated with herbicides: 1975-76 — 341,282 (110)

   90% of acreage treated
   - a. Treflan alone — 178,652
   - b. Treflan mixed with other herbicides — None
   - c. Other dinitroanilines — None
4. Alternative herbicides to Treflan (do not consider other dinitroanilines) (1,12,13,14,15,92, 110)
   - a. Eptam — 4#/A. active
   - b. Premerge — 4.5#/A. active
5. Yield difference: Treflan vs. (1, 12,13,14,15,110)
   - a. Other dinitroanilines — None
   - b. Other herbicides — None
     Accounted for by increase in hand labor
   - c. Cultivation only —
   - d. Cultural practices — No change
6. Change in commodity quality — None (110)
7. Percent of acres treated with alternative herbicide that may not receive sufficient rainfall to activate chemical after application — None (110)
8. Percent of acres treated with alternative herbicide that may not receive first cultivation at the optimal time. — None (110)

9. Increase in number of cultivations if alternative herbicides are used. — 1 additional on 178,652 acres (110)

10. Increase in number of cultivations if no alternative herbicide is used — 2 additional (110)

11. Hand labor if applicable — ________ (110)

    a. Number of acres — ________

    b. Cost per acre per season — ________

12. Shifts to other crops — No shifts (110)

13. Price of herbicide materials: per gal., lb., etc. (110)

    a. Treflan — $7.88/lb. active

    b. Alternatives

        1. Eptam — 3.00/lb. active

        2. Premerge — 2.48/lb. active

BIOLOGICAL INFORMATION IN SUPPORT OF
ECONOMIC ANALYSIS

SOUTHERN PEAS (FRESH & CANNED)(Georgia and Texas)

1. Planted acres - 1976 ave. 75,250

2. Yield per acre - 1976 ave. ______

3. Acres treated with herbicides: 1975-76 ave. 75,250 (110)

   95% of acres treated.

   a. Treflan alone 67,250

      90% of acres treated.

   b. Treflan mixed with other herbicides None

   c. Other dinitroaniline ______

4. Alternative herbicides to Treflan (don't consider other dinitroanilines) (1,12,13,14,15,110)

   a. Furloe 5#/A./active

5. Yield difference: Treflan vs. (1,12,13,14,15,110)

   a. Other dinitroaniline None

   b. Other herbicides None

   c. Cultivation only ______

   d. Cultural practices No change

6. Change in commodity quality None (110)

7. Percent of acres treated with alternative that may not receive sufficient rainfall to activate herbicide after application (110) ______

8. Percent of acreage treated with alternative herbicides that may not receive first cultivation at the optimal time (110) ______

9. Increase in number of cultivations if alternative herbicides are used on 67,250 acres (110) 1.5 additional

10. Increase in number of cultivations if no alternative herbicide is used on 67,250 acres — 3.0 additional (110)

11. Hand labor if applicable. (110)

    a. Number of acres if alternate used — 67,250

    b. Cost per acre per season — 15 hrs/acre @ $2.60

12. Shifts to other crops — (110)

13. Price of herbicide materials: per gal, lb., etc. (110)

    a. Treflan — $7.88/lb./active

    b. Alternatives

        1. Furloe — $3.31/lb./active

BIOLOGICAL INFORMATION IN SUPPORT OF ECONOMIC ANALYSIS

TOMATOES - U. S.

1. Planted acres - 1974-76 ave. 490,467 (120)
   a. For processing 360,197 acres
   b. Fresh market 130,320
2. Yield per acre - 1974 -76 ave. (120)
   a. For processing 21.3 tons
   b. Fresh market 8.3 tons
3. Acres treated with herbicides. About 90% of planted acres. 437,000 (110)
   a. Treflan alone 190,450
      1. Calif. 117,440 acres
      2. Other 73,010 acres

      average use rate is 0.75# active/A.
   b. Treflan mixed with other herbicides 146,800
   c. Other dinitroanilines None
4. Alternative herbicides to Treflan (do not consider other dinitroaniline). (1,2,6,7,12,13,14,15,21,26,27,34,46,92,97,98,106,110)

		190,450	146,800	
a.	Enide	12	-	4#/A. active
b.	Amiben (103)	5%	-	3.5#/A. active
c.	Devrinol	13%	80%	1.0 lb./ active
d.	Tillam	70%	20%	4.0#/A. active

5. Yield difference: Treflan vs. (1,2,6,7,12,13,14,15,110)
   a. Other dinitroanilines None
   b. Other herbicides None
6. Change in commodity quality None (110)
7. Percent of acres treated with alternative that may not receive sufficient rainfall to activate herbicide after application In Calif. all incorporated (110)
8. Percent of acreage treated with alternative herbicides that may not receive first cultivation at the optimal time 20% (110)

   Impact on yield negligible because of increase in hand labor

9. Increase in number of cultivations if alternative herbicides are used.	(110)	2 additional on 73,010 acres
10. Increase in number of cultivations if no alternative herbicide is used	(110)	2 additional in Calif. 3 additional for Other
11. Hand labor if applicable		(110)
a. Number of acres		337,250
b. Cost per acre per season		$26.00
10 hrs/A. at $2.60/hr.		
12. Shifts to other crops:		None (110)
13. Price of herbicide materials: per gal., lb., etc.		(110)
a. Treflan		$7.88/lb. active
b. Trefmid		8.00/lb. active
c. Alternatives		
1. Enide		6.00/lb. active
2. Amiben		5.75/lb. active
3. Devrinol		8.00/lb. active
4. Tillam		3.00/lb. active

BIOLOGICAL INFORMATION IN SUPPORT OF ECONOMIC ANALYSIS

WATERMELONS (REGISTERED FOR WEST ONLY)

1.	Planted acres - 1974-76 ave.	242,267	(120)
2.	Yield per acre - 1974-76 ave.	5.6 T/A.	(120)
3.	Acres treated with herbicides: 1975-76 ave.	193,814	(110)
	a. Treflan alone at 0.75#/A./active (Texas)	20,000	
	b. Treflan mixed with other herbicides	None	
	c. Other dinitroaniline	None	
4.	Alternative herbicides to Treflan (do not consider other dinitroanilines)	(1,6,7,13,14,110)	
	a. Prefar 4# + Alanap 4# as preplant incorporated mixture	20,000 acres / 100%	
5.	Yield difference: Treflan vs.	(1,6,7,13,14,110)	
	a. Other dinitroaniline	None	
	b. Other herbicides	None	
	c. Cultivation only		
	d. Cultural practices	No change	
6.	Change in commodity quality	None	(110)
7.	Percent of acres treated with alternative that may not receive sufficient rainfall to activate herbicide after application	None	(110)
8.	Percent of acreage treated with alternative herbicides that may not receive first cultivation at the optimal time	None	(110)
9.	Increase in number of cultivations if alternative herbicides are used.	None	(110)
10.	Increase in number of cultivations if no alternative herbicide is used.	1 additional	(110)

11. Hand labor if applicable (110)

    a. Number of acres if alternate used 20,000

    b. Cost per acre per season $10.40

       4 hrs/A. @ $2.60/hr

12. Shifts to other crops No shifts (110)

13. Price of herbicide materials: per gal, lbs, etc. (110)

    a. Treflan $7.88/lb./active

    b. Alternatives

       1. Prefar $4.11/lb./active

       2. Alanap $4.20/lb./active

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LONG-RUN ECONOMIC
ANALYSIS

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OF

TRIFLURALIN

United States Department of Agriculture
Economics, Statistics, and Cooperatives Service

and

State Land Grant Universities

and

United States Environmental Protection Agency
Economic Analysis Branch

Washington, D. C. 20250

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CONTENTS

SUMMARY

If trifluralin is cancelled, the income of agricultural producers would likely decline $313.2 million dollars in the long-run as a result of increased production costs and reduced yields. The loss of income for users of trifluralin was estimated at $564.10 million: $151.8 million for cotton; $278.8 million for soybeans; $97.2 million for dry beans, peanuts, sugar beets and sunflowers; and $36.3 million for fruits and vegetables. Additional costs for weed control were estimated to increase $32.7 million for cotton; $150.3 million for soybeans; $53.9 million for dry beans, peanuts, sugar beets and sunflowers; and $25.9 million for fruits and vegetables. Non-users of trifluralin would hve a $250.9 million income gain due to changes in prices.

About 31.6 million acres would be affected, including 19.7 million acres of soybeans, 10.76 million acres of cotton and other field crops, and 1.14 million acres of fruits and vegetables.

Trifluralin is used on about 8.3 million acres or nearly 70 percent of the planted cotton acreage. If the herbicide is cancelled, yields would likely decline about 7.6 percent on those acres from about 453 to about 419 pounds of lint per acre. Total lint production would decline 286 million pounds and total seed production 479 million pounds. Production costs would increase $32.7 million or about $3.93 per acre.

In estimating the impact on cotton producers, a price elasticity of demand of -1.5 was evaluated. Assuming a base price of 60 cents per pound of lint, an increase of 2.2 cents per pound resulted. This increase is

believed to represent the price change that would occur as a result of a trifluralin cancellation, assuming other factors are constant. Trifluralin users would incur a loss in income of $151.8 million and non-users a gain of $36 million. However, the impact would vary by region. It is estimated that cotton producers in the Southeast using trifluralin are least affected, losing $1.5 million as a result of a trifluralin cancellation. Users of trifluralin in the Southern Plains and Southwest are estimated to have income losses of $58.1 million and $79.5 million, respectively.

An estimated 19.7 million acres of soybeans (38 percent of the planted acreage) were treated with trifluralin. With a cancellation, 19.4 million acres are expected to remain in soybeans and 340,000 acres would likely be shifted to corn production. Overall soybean price would increase 7.6 percent from $5.64 to $6.07 per bushel and corn price would decline 0.8 percent from $2.68 to $2.658 per bushel.

On the 340,000 diverted acres, the value of foregone soybean income would be $42.9 million, which is offset by $52.1 million in net income from corn. The net effect is an increase in income of $9.2 million or $27 per shifted acre. On the remaining 19.36 million treated soybean acres, yields would decline 11.2 percent from about 28.3 to 25.1 bushels per acre and weed control costs would increase $150.3 million or $7.76 per acre. Income would decline $288 million. In total, there would be an income reduction of $278.8 million, or about $14.15 per acre, on the 19.7 million trifluralin-treated acres traditionally producing soybeans.

The cancellation would have external effects on the soybean and corn producers not using trifluralin. Soybean producers not using trifluralin would benefit from the $.43 per bushel price increase as a result of the

cancellation, and the value of their output would increase $337.2 million. The value of corn producers' output would decline by $122.3 million because of the 2.2 cents per bushel reduction in corn price after soybean acres are diverted to corn production. The total impact on soybean and corn producers not using trifluralin would be an increase in income of $214.9 million. The total impact on users and non-users producing soybeans and corn would be an income reduction of $63.9 million.

Trifluralin is used on 79.2 percent of dry beans, 19.6 percent of the peanut, 19.3 percent of the sugar beets, and 65.0 percent of the sunflower acreage. If the herbicide is cancelled, returns on those four crops would likely decline $97.2 million. Production costs would increase $53.9 million, including $7.4 million for added cultivation, $48.4 million for hand labor, and -$1.9 million for alternative herbicides. Nearly 82 percent of the increased hand labor costs would be for dry beans amounting to $32 per acre. The value of output lost on dry beans, peanuts, and sunflower acreage would be $43.3 million.

Trifluralin use varies with different fruit and vegetable crops. Although it is used on only 2 percent of cucumbers, it is applied to 40-65 percent of many other fruits and vegetables and nearly 90 percent of the lima beans, collards and okra, and southern peas. If the trifluralin is cancelled, total fruit and vegetable income would decline about $36.3 million. Production costs would increase $25.9 million, including $16.0 million for hand weeding, $5.9 million for alternative herbicides, and $4.0 million for mechanical cultivation. The lost value of output would be $10.4 million because of a yield reduction on processing peas. On a per acre basis, the average impact for most fruits and vegetables would range from $30 to $60. Potatoes would be affected the least at $5.38 per acre, but collards and okra would be impacted at nearly $95 per acre.

In addition to the crops discussed above, there are others on which trifluralin is used, including tree fruits and nuts, grapes, guar, and mung beans. Although economic analyses were not undertaken on these commodities because of data limitations, trifluralin use may be important.

INTRODUCTION

The Environmental Protection Agency (EPA) received a petition on February 3, 1977 to suspend the registrations of trifluralin and trichlorobenzoic acid. Trifluralin is a preplant herbicide used extensively on cotton, soybean, other field crop and fruits and vegetables. For some crops, cancellation of trifluralin use would have large impacts, reducing yields and/or increasing production costs because of less effective herbicides and non-chemical substitutes. However, in other cases, effective substitutes are available for some crops and in some geographical areas, and it is not expected that crop yield or production costs would be adversely affected.

This report examines the long-run economic implications of a possible cancellation.

SCOPE

The long-run economic impact of a possible cancellation of the principal trifluralin use patterns is analyzed. The major use patterns examined include trifluralin on cotton, soybeans, dry beans, peanuts, sugar beets, sunflowers and fruits and vegetables.

The economic analysis focuses on the changes in income that could result from a cancellation. Distribution effects were investigated, where appropriate, for users versus non-users, among regions and between crops. Changes in consumer expenditures for products at the farm level are presented, but changes at the retail level were not investigated. Social or community effects are not investigated, but could occur as a result of economic dislocations

associated with income changes, income redistribution and the relocation of agricultural production. The analysis is applicable to longer-run impacts (3 to 5 years) after a possible cancellation.

Partial budgeting was the technique used to perform the long-run economic analysis. The National Herbicide Assessment Team for Trifluralin provided information on acreage treated with trifluralin, weed control input requirements and yield differences for the alternatives most likely to be used in place of trifluralin. Crop acreage, production and commodity prices are based, for the most part, on 1974-76 data. Crop production costs were based on projections for 1977.

Figure 1

OVERALL SUMMARY OF THE LONG-RUN ECONOMIC EVALUATION OF TRIFLURALIN CANCELLATION (PARTIAL BUDGETING) 1/

Crop/Site	Extent of Use: Million acres treated	Extent of Use: Percent of total acres	Availability of alternative herbicides	Economic Impact: Type	Economic Impact: Million dollars	Economic Impact: Dollars per acre	Significance
Cotton	8.31	70	Several	User	-151.8	18.26	Major
				Non-user	+36.0	--	
				Total	-115.8	--	
Soybeans	19.7	38	Several	User 2/			
				Acres in soybeans	-288.0	-8.32	
				Acres to corn	+9.2	-15.83	
				Total	-278.8	--	
				Non-users 3/		—	
				Soybean price change	+337.2	—	
				Corn price change	-122.3		
				Total	+214.9		
				Total users and non-users	-63.9	—	Major
Fruits and vegetables	1.14	2.1 to 90.3	Few for okra and collards; all crops not fully investigated	User 4/	-36.3	-31.78	Major
Other field crops	2.45	19.3 to 79.2	Several	User 4/	-97.2	39.73	Major
All commodities	31.6	—		Users and non-users	313.2	—	

— Not applicable.
1/ Based on information contained in Figures 2, 3, 4, and 5.
2/ Based on 19.36 million acres remaining in soybeans and 340,000 acres shifted to corn.
3/ Based on a price increase of $.43 per bushel for soybeans and a decrease of 2.2 cents per bushel for corn.
4/ Dollars per acre taken from Figures 4 and 5.

Figure 2

SUMMARY OF LONG-RUN BENEFIT ANALYSIS OF TRIFLURALIN USE ON COTTON

A. USE: Cotton

B. MAJOR PESTS CONTROLLED: Several grass and broadleaf weeds

C. ALTERNATIVES:

State recommendations/ Federal guidelines: DCPA, nitralin, diuron, flumeturon, butralin, dinitramine, fluchloralin, profluralin, dalapon, MSMA, paraquat, norflurazon, perfluidone, oil, DSMA, dinoseb, glyphosate, linuron, TCA, and methazole

Non-chemical controls: Cultivation and hoeing

Selected alternatives: Varied by region. Included one application of either fluchloralin, dinitramine, pendimethalin, profluralin, fluometuron, diuron, prometryn, norflurazon, DCPA, bensulide, alachlor, various mixtures, cultivation, and hoeing.

Comparative costs:

Region	Added cost of weed control: Total (mil. dol.)	Added cost of weed control: Per acre (dollars)
2	0.4	0.93
4	(-5.4)	(-1.45)
6	26.7	24.65
7	11.0	3.58
All regions	32.7	3.93

Comparative performance:

Region	Lint cotton yield per treated acre: With Trifluralin (lbs.)	Lint cotton yield per treated acre: Without Trifluralin (lbs.)
2	405	388
4	417	397
6	957	858
8	326	294
All regions	453	419

D. EXTENT OF USE:

1974-76: 8.31 million acres (69.5% of planted acres). Region 2 - 432,000 acres (55%); Region 4 - 3,724,000 acres (90%); Region 6 - 1,083,000 acres (75%); Region 7 - 3,075,000 acres (55%).

E. ECONOMIC IMPACTS: USERS ANALYTICAL METHODOLOGY PRODUCERS:

Producers: Partial budgeting approach

User:

Region	Change in income Total a/	Per acre
2	-1.5	-3.47
4	-12.7	-3.41
6	-79.5	-73.41
7	-58.1	-18.89
All regions	-151.8	-18.26

a/ Demand elasticity of -1.5.

Non-User: $36.0 million income gain

Users and Non-Users: $115.8 million income loss

Consumer: Will expend at least $53 million more for slightly less cotton.

Macroeconomic: Not investigated

F. SOCIAL/COMMUNITY IMPACTS: Not investigated

G. LIMITATIONS: Partial equilibrium analysis.

H. PRINCIPAL ANALYSTS AND DATE:

H. Delvo, USDA
R. Freund, EPA
H. Gaede, EPA
G. O'Mara, EPA
W. Quinby, USDA

August 4, 1978

Figure 3

SUMMARY OF LONG-RUN BENEFIT ANALYSIS OF TRIFLURALIN USE ON SOYBEANS

A. USE: Soybeans

B. MAJOR PESTS CONTROLLED: Several grass and broadleaf weeds

C. ALTERNATIVES:

State recommendations/ Federal guidelines: States recommend several including chloramben, alachlor, linuron, dinitramine, fluchloralin, penoxalin, profluralin, CIPC, metribuzin, dinoseb, 2,4-DB, and fluorodifen

Non-chemical controls: Cultivation and hoeing, rotation to corn, and delayed planting

Selected alternatives: Alachlor and naptalam, alachlor alone, alachlor and metribuzin, vernolate, chloramben, linuron and additional cultivations with last of aforementioned and non-chemical controls listed above.

Comparative costs:

Region	Added cost of weed control a/ Total	Per Acre
	mil. dol.	dollars
2	15.2	6.08
3	27.1	5.15
4	61.8	8.83
5	46.2	10.04
All regions	150.3	7.76

a/ For acres remaining in soybeans

Comparative performance:

Region	Yield Per Acre With Trifluralin	Without Trifluralin
	bushels	bushels
2	26.0	24.4
3	30.0	29.2
4	28.0	23.2
5	28.0	23.7
All regions	28.0	25.1

D. EXTENT OF USE:	1976: 19.7 million acres - 38% of planted acres
E. ECONOMIC IMPACTS:	
Analytical methodology:	Partial budgeting and given elasticity
Producers:	
Users:	$279 million decrease in users income
Non-users:	$215 billion windfall gain
Net impact:	$64 million loss
Consumer:	Consumers will pay at least $142 million more for a smaller soybean crop and $39 million less for more corn.
Macroeconomic:	Not investigated
F. SOCIAL/COMMUNITY IMPACTS:	Not investigated
G. LIMITATIONS:	Short-run partial equilibrium analysis
H. PRINCIPAL ANALYSTS AND DATE:	H. Delvo, USDA R. Freund, EPA H. Gaede, EPA G. O'Mara, EPA W. Quinby, USDA August 4, 1978

Figure 4

SUMMARY OF LONG-RUN BENEFIT ANALYSIS OF TRIFLURALIN USE ON FRUITS AND VEGETABLES

A. USE:	Fruits and Vegetables: Potatoes, tomatoes, peas, snap beans, lima beans, cabbage, broccoli, Brussels sprouts, cauliflower, carrots, peppers, celery, watermelons, cantaloupes and honey dews, mint, southern peas, collards, okra, and cucumbers.
B. MAJOR PEST CONTROLLED:	Several grass and broadleaf weeds
C. ALTERNATIVES:	
State recommendations/ Federal guidelines:	Sample recommendations for the representative crop of tomatoes: pebulate, diphenamid, chloramben, bensulide, DCPA, nitralin, isopropalin, methyl bromide and metham. For peas: DNPB, propachlor, dalapon, CDAA, DCPA. For okra: diphenamid and profluralin. For collards: CDEC and DCPA.
Non-chemical controls:	Mechanical cultivation and hand weeding.
Selected alternatives:	Diphenamid, bensulide, naptalam, alachlor, metribuzin, terbacil, linuron, DNPB, chloramben, napropamide, pebulate, dalapon, EPTC, profluralin, nitrofen, dinitramine, oil, chlorpropham, mechanical cultivation, and hand weeding.
Comparative costs:	Per acre decrease in revenue (weed control costs and reduced yields) relative to trifluralin ranged from \$5.38 for potatoes to \$94.72 for collards and okra.
D. EXTENT OF USE:	1,142,334 acres for considered crops.
E. ECONOMIC IMPACTS:	
User:	Total cost increase and value of output loss of \$36,305,000. \$31.78 per acre.
Consumer:	Producer impacts of \$36,305,000 would be largely shifted to the consumers.
Macroeconomic:	Not investigated.

F. SOCIAL/COMMUNITY IMPACTS: Not investigated.

G. LIMITATIONS OF ANALYSIS: An in-depth study was not conducted.

H. PRINCIPAL ANALYSIS AND DATE: H. Delvo, USDA

H. Gaede, EPA

August 4, 1978

Figure 5

SUMMARY OF LONG-RUN BENEFIT ANALYSIS OF TRIFLURALIN ON OTHER FIELD CROPS

A. USE:	Other field crops: dry beans, peanuts, sugar beets, and sunflowers
B. MAJOR PESTS CONTROLLED:	Several grass and broadleaf weeds
C. ALTERNATIVES:	
State recommendations/ Federal guidelines	For dry beans: chloramben, dinitramine, DNBP, EPTC, and alachlor. For peanuts: benefin, dinitramine, vernolate, alachlor, nitralin, diphenamid, chloramben, 2,4-DB, various herbicide combinations and cultivation. Sample recommendations for sugar beets: several including pebulate, cycloate, EPTC, diallate, TCA, barban, dalapon, endothall, desmedipham, pyrazon, phenmedipham, and propham. For sunflowers: EPTC, chloramben, dinitramine, DNBP, EPTC, and alachlor.
Non-chemical controls:	Mechanical cultivation and hand weeding
Selected alternatives:	Dry beans: profluralin, dinitramine, EPTC, alachlor, chloramben, DNBP, and hand weeding. Peanuts: alachlor, vernolate, dinitramine, mechanical cultivation and hand weeding. Sugarbeets: EPTC, mechanical cultivation and hand weeding. Sunflowers: chloramben, profluralin, EPTC, and mechanical cultivation.
Comparative costs:	Change in per acre weed control costs without trifluralin: Dry beans ------- \$1.68 to \$27.09 Peanuts --------- \$1.68 to \$16.06 Sugar beets ----- \$44.59 Sunflowers ------ -\$0.19 to \$11.84

D. EXTENT OF USE:	2,447,880 acres: dry beans - 1,232,000 acres (79.2% of planted acres) peanuts - 301,000 acres (19.6% of planted acres) sugar beets - 264,880 acres (19.3% of planted acres) sunflowers - 650,000 acres (65% of planted acres)
E. ECONOMIC IMPACTS:	
<u>User</u>:	Total cost increase and lost value of production $97,245,000 Dry beans: $59,672,000 Peanuts: $14,723,000 Sugar beets: $11,811,000 Sunflowers: $11,039,000 Average economic impact per acre of $39.73 Dry beans - $48.44 Peanuts - $48.91 Sugar beets - $44.59 Sunflowers - $16.98
<u>Consumer</u>:	Producer impacts of $97,245,000 largely shifted to the consumers
<u>Macroeconomic</u>:	Not investigated
F. SOCIAL/COMMUNITY IMPACTS:	Not investigated
G. LIMITATIONS OF ANALYSIS:	An in-depth study was not conducted
H. PRINCIPAL ANALYSTS AND DATE:	H. Delvo, USDA H. Gaede, EPA August 4, 1978

LONG-RUN ECONOMIC IMPACT ANALYSIS ON COTTON

by

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The estimated long-run economic impact of a trifluralin suspension on cotton was based on the following procedure and assumptions:

1. Trifluralin and trifluralin combinations are applied once during the growing season. Trifluralin is applied as a preplant-broadcast-incorporated treatment.
2. U.S. 1971-76 average planted acreage and yield per planted acre were used as a base for the analysis.
3. The base acreage treated with trifluralin was estimated by agricultural scientists using published data, when available, and their knowledge of herbicide use patterns for the crops considered (Table 2).
4. Alternative methods of weed control were specified by agricultural scientists (Table 3). These alternatives were assumed to be the most viable if trifluralin were not available. In making this determination; the efficacy, market availability, and treatment costs per acre of the alternatives were considered.
5. The prices for alternative herbicides would not change and would be available in sufficient quantities. Also, sufficient labor would be available for mechanical and hand weed control at prevailing market prices.

6. The number of trifluralin treated acres allocated to the various weed control programs for each crop was estimated by agricultural scientists.

7. Production losses were estimated by the agricultural scientists when alternative weed control programs were not considered as effective as trifluralin (USDA, Biological Information in Support of Economic Analysis, 1977). These estimates were based on their experience and judgment about annual variations in production associated with different herbicides and mechanical controls under general field conditions and data from experimental research plots. However, research plot data may vary from actual field experience because they are obtained under specialized conditions.

8. Cultivation costs by region were derived from the 1975 FEDS Budget prepared by the Economic Research Service, USDA. They range from \$1.85 to \$2.77 per operation.

9. The base price for lint cotton was assumed to be \$0.60 per pound. In determining a new price for lint cotton as a result of a trifluralin cancellation, the market was evaluated assuming that some supplies of cotton from export markets would flow to the domestic market in response to supply shortfalls. A long-run price elasticity of demand needs to be estimated.

10. The price of cotton seed was assumed to be constant at \$0.05 per pound. A demand elasticity coefficient for cottonseed is not available so no estimate of price change was made. However, the decrease in cottonseed and accompanying decrease in soybean

production as a result of trifluralin cancellation would undoubtedly increase the price of cottonseed.

11. Partial budgeting techniques were used to estimate the long-term (3 to 5 years) impact of a trifluralin cancellation.

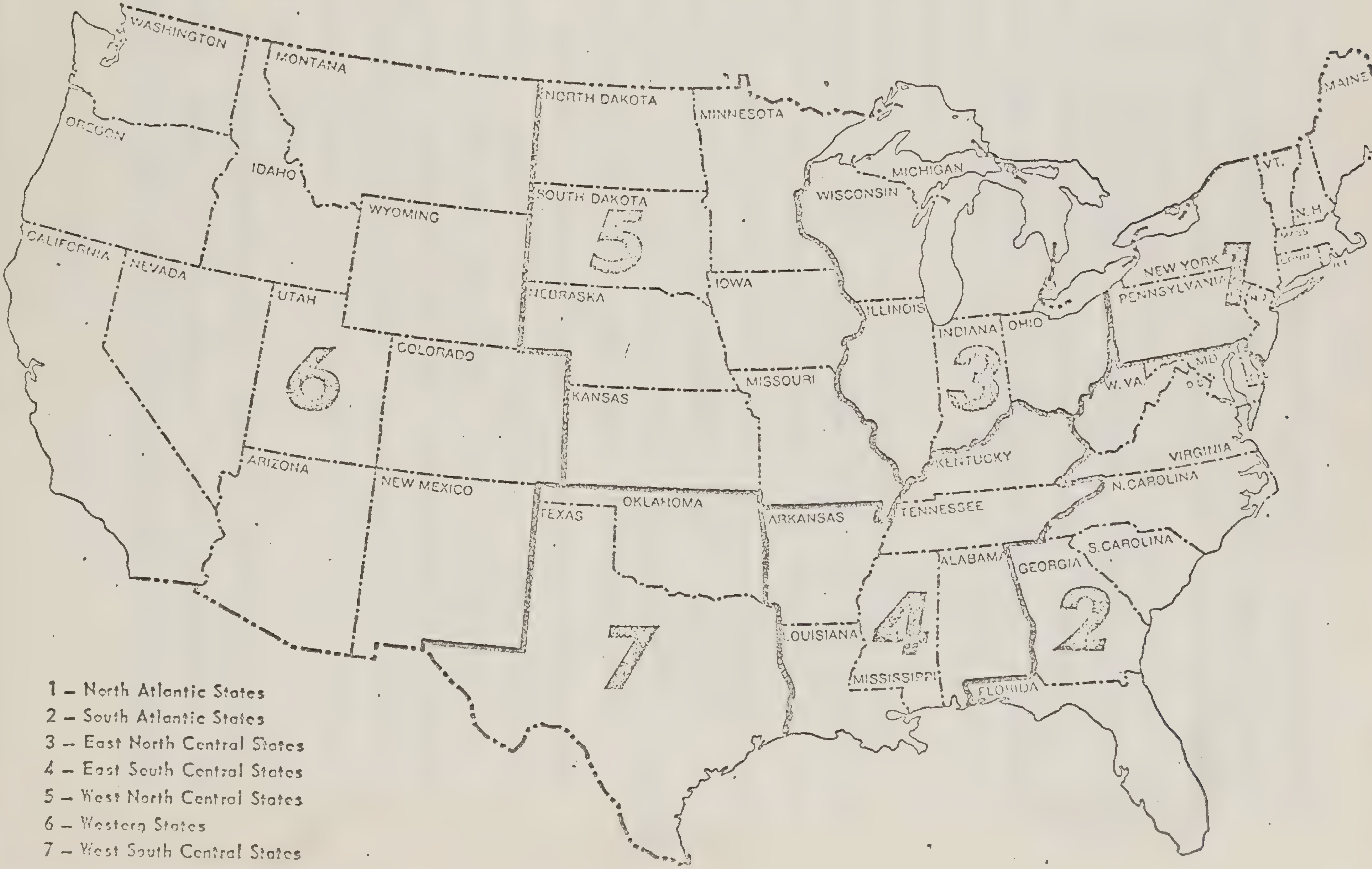
12. The study area included the Southeast, Delta, Southern Plains and Southwest cotton producing regions and are identified as Regions 2, 4, 7 and 6. For this study Missouri was included in Region 4 (Figure 1).

Results

Triflůralin is used on 69.5 percent of the U.S. cótton acreage either alone or as a mixture. A cancellation of trifluralin portends a significant decline in cotton production. The diminished supply capability as reflected by increased costs and decreased yields on trifluralin treated acres will to some extent be offset by increased price for the lint cotton that is produced on these acres. The revenue to cotton producers on non-trifluralin treated acres also will be affected as this cotton will be sold at the higher price. To the producers with non-treated acres, the price rise will be a windfall gain as there will be no offsetting cost increases.

An average lint cotton yield decline of 7.6 percent on the trifluralin acres (decrease from an average of about 453 to 419 pounds per year) is expected. This leads to a 286 million pound reduction in output (Table 1). Regionally, the impact ranges from a decrease in production of 7 million pounds in Region 2 to 107 million pounds in Region 7. The percentage declines (in production) for trifluralin treated acres by region are: Region 2: 4.0 percent; Region 4: 4.8 percent; Region 6: 10.3 percent; and Region 7: 9.8 percent.

DOANE COUNTRYWIDE FARM PANEL REGIONS



1 — North Atlantic States
2 — South Atlantic States
3 — East North Central States
4 — East South Central States
5 — West North Central States
6 — Western States
7 — West South Central States

The cost of alternative weed control programs are estimated to increase $32.7 million or $3.93 per trifluralin treated acre as a result of a cancellation. The largest increase is in Region 6 at $26.7 million; weed control costs decrease $5.4 million in Region 4. On a per acre basis, cost increases are: Region 2: $0.93; Region 4: (-$1.45); Region 6: $24.65; and Region 7: $3.58. In Region 4, the alternative weed control costs are less because the cultivations which substitute for trifluralin are less expensive. However, cultivations are less effective and yields would be lower causing a reduction in per acre revenue.

Changes in domestic cotton production levels will affect the price farmers receive for cotton and ultimately what consumers pay for cotton products. The magnitude of the price movement is dependent upon the price elasticities of supply and demand for cotton. For this long-run (3-5 years) analysis, the price elasticity of demand (with consideration given to supply responses) was estimated at -1.5. This compared with an elasticity of -1.0 used in the short-run analysis (USDA/State and EPA, Short-run Economic Analysis of Trifluralin, 1977).

In the May 1977 analysis, the short-run domestic elasticity of demand was estimated to range from -0.2 to -0.3 and the export elasticity of demand was estimated to range from -2.0 to -2.5. For the short-run analysis, the price elasticity of demand for cotton was assumed to be -0.3 for the domestic market and -2.3 for the export market. These elasticities were weighted by the domestic (65 percent) and export (35 percent) market shares resulting in an over all elasticity of -1.0.

With a longer period for market adjustments, the demand for cotton becomes more elastic. The price elasticity of domestic demand for lint cotton increases and is estimated to double with long-run adjustments (Fibers and

Oil Program, Commodity Economics Division, ESCS, USDA, August 1978). For this long-run analysis the price elasticity of domestic demand was assumed to be -0.6.

The price elasticity for export demand is a more complicated function. In the short-run, the U.S. export price elasticity of demand for cotton is very elastic because as the U.S. price increases, with world prices remaining stable, buyers shift to other countries. With more time for market adjustment, export demand becomes inelastic and is estimated to be about -0.65 in the intermediate term (Fibers and Oils Program, 1978). In the long-run export demand again becomes elastic and was assumed to be -2.4 for this study.

Market shares, domestic and export, are changing over time. In the short-run analysis the estimated shares were 65 percent for the domestic and 35 percent for the export market. For the 1978 cotton crop the market shares are estimated to be 50 percent for domestic and 50 percent for export. These market shares were used to estimate the overall long-run price elasticity of -1.5 for lint cotton.

Under this assumption, the domestic and export markets were combined and evaluated. The long term (1971-76 average) cotton supplies available were estimated at 5,403 million pounds, but after a trifluralin cancellation 5,117 million pounds would be available. The 286 million pound loss in production represents a 5.44 percent decrease $\left(286 \div \frac{5,403 + 5,117}{2}\right)$. With an elasticity of demand of -1.5, cotton price was estimated to increase 3.63 percent. This results in a 2.2 cent per pound increase in cotton prices (60 cents x .0363). Thus, as a result of trifluralin cancellation, the price of cotton would increase from \$0.60 to \$0.622 per pound.

Cotton producers using trifluralin would incur a loss of \$152 million (Table 1). The value of lost lint and cottonseed output for trifluralin

users would be $196 million, but this would be partially offset by a gain of $76 million from the 2.2 cent per pound price increase on the cotton produced. Cotton producers not using trifluralin would have increased revenue of about $36 million as a result of the price increase for lint cotton. Thus, the total value of the cotton crop (lint and seed) from all acres would be reduced $83 million as the result of a trifluralin cancellation. Total consumers' expenditures would increase and they would have less cotton available.

Summary

A $152 million loss of income for trifluralin users and a $36 million gain for non-users might be expected. The expected value of the lint and cottonseed crop would decline $83 million as a result of a trifluralin cancellation. Total farm lint cotton output would decrease by 286 million pounds and consumers' expenditures are expected to increase at least $53 million for lint cotton products.

It must be cautioned that this analysis is comparative statics. The price changes indicate relative magnitudes and should be used for comparison purposes only. They are not predictions. The real world is a dynamic system. Many things can happen to magnify or dampen the estimated impacts on cotton producers and consumers. It can be concluded that a cancellation of trifluralin increases the uncertainty in an already uncertain business.

Table 1. Trifluralin cancellation on cotton: long-run impact on users and non-users based on a 1.5 price elasticity of total demand

Item	Unit	Regions 1/ 2	4	6	7	Total
Acres planted (1971-76 average) 2/	1,000	785	4,138	1,444	5,591	11,958
Economic impact on trifluralin users:						
Acres treated with trifluralin 3/	1,000	432	3,724	1,083	3,075	8,314
Lint cotton production: 4/						
With trifluralin	mil. lbs.	175	1,553	1,036	1,002	3,766
Without trifluralin	" "	168	1,479	929	904	3,480
Change in lint production	" "	7	74	107	98	286
Change in cottonseed production without trifluralin 5/	" "	12	124	179	164	479
Reduction in income:						
Added cost of weed control 6/	mil. dol.	.4	(-5.4)	26.7	11.0	32.7
Value of lost lint cotton 7/	" "	4.2	44.4	64.2	58.8	171.6
Value of lost cottonseed 8/	" "	.6	6.2	9.0	8.2	24.0
Net reduction in revenue	" "	5.2	45.2	99.9	78.0	228.3
Gain from change in cotton price 9/	" "	3.7	32.5	20.4	19.9	76.5
Net income change on trifluralin treated acres	" "	-1.5	-12.7	-79.5	-58.1	-151.8
Economic impact on non-users of trifluralin from the change in cotton price 10/	" "	--	--	--	--	36.0

-- Not applicable.

1/ Region 2 - Southeast; Region 4 - Delta; Region 6 - Southwest; and Region 7 - Southern Plains.

2/ Crop Production Annual Summary 1973 and 1976. U.S. Dept. Agr., Statis. Rptg. Serv. CrPr 2-1 (74) and CrPr 2-1 (77).

3/ Table 2.

4/ Tables 2 and 3.

5/ Change in lint production times 1.67.

6/ Difference between the trifluralin weed control program costs (Table 2) and the cost of the alternative weed control program (Table 3).

7/ The base price for lint cotton was assumed to be $0.60 per pound.

8/ The price for cottonseed was assumed to be constant at $.05 per pound.

9/ Production without trifluralin times $.022 per pound. It was estimated that the price of cotton would increase from $0.60 to $0.622 per pound as a result of the reduced output.

10/ Production on non-trifluralin treated acres was estimated at 1,637 million pounds (1971-76 average production of 5,403 million pounds minus 3,766 million pounds produced on trifluralin treated acres - (Table 2). Increase in cotton price was estimated to be $0.022 per pound (footnote 9).

Table 2. Estimated current trifluralin treated acres, weed control costs and lint cotton production, by region

Region and herbicide used	Acres treated 1/	Application rate per acre	Weed control cost 2/		Lint production 3/	
			Per acre	Total	Per acre	Total
	1,000	pounds	dollars	mil. dol.	pounds	mil. lbs.
Region 2						
Trifluralin (alone)	78.5	.5	3.75	.3	405	31.8
Trifluralin + fluometuron	176.6	.5 + 1.5	11.73	2.1	405	71.5
Trifluralin + diuron	141.3	.5 + .75	6.00	.8	405	57.2
Trifluralin + prometryn	35.3	.5 + 2.0	11.75	.4	405	14.3
Total	431.7		--	3.6	--	174.8
Region 4						
Trifluralin (alone)	206.9	.75	5.63	1.2	417	86.3
Trifluralin + fluometuron	1,406.9	.75 + 1.5	13.61	19.1	417	586.7
Trifluralin + diuron	1,758.6	.75 + 1.0	8.63	15.2	417	733.3
Trifluralin + prometryn	175.9	.75 + 2.0	13.63	2.4	417	73.4
Trifluralin + norflurazon	175.9	.75 + 2.0	15.63	2.7	417	73.4
Total	3,724.2		--	40.6	--	1,553.1
Region 6						
Trifluralin (alone)	938.6	.75	5.63	5.3	957	898.2
Trifluralin + prometryn	144.4	.75 + 1.6	12.03	1.7	957	138.2
Total	1,083.0		--	7.0	--	1,036.4
Region 7						
Trifluralin (alone)	2,795.5	.75	5.63	15.7	326	911.3
Trifluralin + prometryn	156.5	.75 + 1.5	11.63	1.8	326	51.0
Trifluralin + alachlor	92.2	.75 + 1.5	11.63	1.1	326	30.1
Trifluralin + diuron	30.8	.75 + 1.0	8.63	.3	326	10.0
Total	3,075.0		--	18.9	--	1,002.4
All regions	8,313.9			70.1		3,766.7

-- Not applicable
1/ Estimated by National Herbicide Assessment Team for Trifluralin.
2/ Costs of herbicides per pound AI are as follows: Trifluralin - \$7.50; fluometuron - \$5.32; diuron - \$3.00; prometryn - \$4.00; norflurazon - \$5.00; and alachlor - \$4.00
3/ 1971-76 average yield per planted acre. Calculated from annual crop production summaries, USDA, Statistical Reporting Service, CrPr 2-1 (74) and CrPr 2-1(77).

Table 3. Estimated long-run acreage treated, weed control costs and lint cotton production for alternative herbicides used to replace trifluralin, by region

Region and herbicide used	Acres treated 1/	Application rate per acre 1/	Additional cultivations per acre 1/	Weed control cost 2/ Per acre	Weed control cost 2/ Total	Lint production 3/ Per acre	Lint production 3/ Total
	1,000	pounds		dollars	mil. dol.	pounds	mil. lbs.
Region 2							
Other dinitroanilines	78.5	4/	1	8.15 5/	0.6	405	31.8
Fluometuron	176.6	1.5	2	12.16	2.1	389	68.7
Diuron	141.3	0.75	2	6.43	0.9	381	53.8
Prometryn	35.3	2.0	2	12.18	0.4	381	13.4
Total	431.7				4.0		167.7
Region 4							
Other dinitroanilines	206.9	4/	1	7.95 5/	1.6	413	85.4
Dinitroaniline + fluometuron	82.8	4/ + 1.5	1	15.93	1.3	413	34.2
Dinitroaniline + diuron	103.5	4/ + 1.0	1	10.95	1.1	413	42.7
Dinitroaniline + prometryn	10.3	4/ + 2.0	1	15.95	0.2	413	4.3
Dinitroaniline + norflurazon	10.3	4/ + 2.0	1	17.95	0.2	413	4.3
Fluometuron	1,324.2	1.5	2	11.68	15.5	400	529.7
Diuron	1,655.2	1.0	2	6.70	11.1	392	648.8
Prometryn	165.5	2.0	2	11.70	1.9	392	64.9
Norflurazon	165.5	2.0	2	13.70	2.3	392	64.9
Total	3,724.2				35.2		1,479.2
Region 6							
Other dinitroanilines	72.2	4/	1	8.60 5/	0.6	909	65.6
DCPA	563.2	9.0	1	34.31	19.3	861	484.9
Bensulide	46.9	2.0	1	10.76	0.5	813	38.1
Prometryn	56.3	1.6	1	8.94	0.5	718	40.4
Cultivation only	37.5	--	3	7.62	0.3	718	26.9
Cultivation + hand hoeing	96.8	--	3	52.62 6/	5.1	861	83.3
DCPA + prometryn	181.9	9.0 + 1.6	0	38.17	6.9	909	165.3
Bensulide + prometryn	28.2	2.0 + 1.6	1	17.16	0.5	861	24.3
Total	1,083.0				33.7		928.8
Region 7							
Other dinitroanilines	444.7	4/	1	7.89 5/	3.5	326	145.0
Prometryn	1,257.9	1.5	2	9.66	12.2	293	368.6
Alachlor	782.6	1.5	2	9.66	7.6	293	229.3
Diuron	447.3	1.0	2	6.66	3.0	261	116.7
Cultivation + hand hoeing	142.5	--	3	25.49 7/	3.6	310	44.2
Total	3,075.0				29.9		903.8
All Regions	8,313.9				102.8		3,479.5

-- Not applicable
1/ Estimated by National Herbicide Assessment Team for Trifluralin. No acreage breakdown was made for specific dinitroanilines.
2/ Treatment costs include additional cost of cultivation and hoeing. Herbicide cost per pound a.i. are as follows: fluometuron - $5.32; diuron - $3.00; prometryn - $4.00; norflurazon - $5.00; alachlor - $4.00; DCPA - $3.53; bensulide - $4.11; fluchloralin - $6.50; dinitramine - $11.24; pendimethalin - $5.38; and profluralin - $7.62. Cultivation costs are: Region 2 - $2.09; Region 4 - $1.85; Region 6 - $2.54; and Region 7 - $1.83.
3/ Lint cotton yield per planted acre without trifluralin estimated by National Herbicide Assessment Team based on yield with trifluralin (Table 2).
4/ The other dinitroanilines with application rates per acre used to replace trifluralin include: fluchloralin - .9 lbs. a.i.; dinitramine - .5 lbs. a.i.; pendimethalin - 1.0 lbs. a.i.; and profluralin - .8 lbs. a.i.
5/ A composite treatment cost per acre (application rate x price per lb. a.i.) was developed based on a weighted average that considered an estimated market share for each dinitroaniline.
6/ Includes $45 for hand labor.
7/ Includes $20 for hand labor.

LONG-RUN ECONOMIC IMPACT ANALYSIS ON SOYBEANS

by

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The estimated long-run economic impact of a trifluralin cancellation on soybeans was based on the following procedure and assumptions:

1. Trifluralin and trifluralin combinations are applied once during the growing season. Trifluralin is applied as a preplant-broadcast-incorporated treatment.
2. U.S. 1974-76 average planted acreage and yield per planted acre were used as a base for the analysis.
3. The base acreage treated with trifluralin was estimated by agricultural scientists using published data, when available, and their knowledge of herbicide use patterns for the crops considered (Table 2).
4. Alternative methods of weed control were specified by agricultural scientists (Table 3). These alternatives were assumed to be the most viable if trifluralin were not available. In making this determination; the efficacy, market availability, and treatment costs per acre of the alternatives were considered.
5. The prices for alternative herbicides would not change and would be available in sufficient quantities. Also, sufficient labor would be available for mechanical cultivation at prevailing market prices.

6. The number of trifluralin treated acres allocated to the various weed control programs for each crop was estimated by agricultural scientists.
7. Production losses were estimated by the agricultural scientists when alternative weed control programs were not considered as effective as trifluralin (USDA, Biological Information in Support of Economic Analysis, 1977). These estimates were based on their experience and judgment about annual variations in production associated with different herbicides and mechanical controls under general field conditions and data from experimental research plots. However, research plot data may vary from actual field experience because they are obtained under specialized conditions.
8. A per acre cost of $2.88 for each additional cultivation was derived from the 1975 FEDS Budget prepared by the Economic Research Service, USDA.
9. The base price estimated for soybeans was $5.65 per bushel and $2.68 per bushel for corn (1974-76 average). Price changes as a result of decreased soybean output were estimated using revenue flexibility coefficients published by ERS, USDA. These coefficients were estimated using a simultaneous equation model and are $0.60 per bushel for soybeans and $0.069 per bushel for corn for each 100 million bushel change in production.
10. The substitution of corn on trifluralin treated soybean acreage was estimated by agricultural scientists to be about 340,000 acres in Region 3.

11. Partial budgeting techniques were used to estimate the long-term (3 to 5 years) impact of a trifluralin cancellation.
12. The study area included the Southeast, Delta, Corn Belt, Lake States, and Northern Plains (Regions 2, 3, 4, and 5 on Figure 1).

Results

Producers' income on trifluralin treated acres was estimated to decrease $279 million as the result of a cancellation: $288 million would be lost on acreage that stayed in soybean production and $9 million would be gained on acreage shifted to corn (Table 1). Of the $288 million loss, $150 million results from increased weed control costs and $138 million from changes in the value of soybean production. The value of decreased yields was estimated at $347 million but they were partially offset by a gain of $209 million from a $0.43 per bushel increase in the soybean price. The $9 million gain on land shifted to corn is the difference between expected returns from soybeans with trifluralin ($43 million) and the returns from corn ($52 million) taking into account price and production cost changes.

The economic impact on non-users of trifluralin who produce soybeans and corn would be a gain of $215 million. They would gain $337 million from an estimated $0.43 per bushel increase in soybean price but would lose $122 million from an estimated 2.2 cent drop in corn prices. Farmers grow both soybeans and corn so the impact would be spread over more individuals and a wider geographic area than if they specialized in one crop.

Of the 19.7 million acres treated with trifluralin it was estimated that 19.36 million acres would remain in soybeans and 0.34 million acres would be shifted to corn. Production on the acres remaining in soybeans would decrease 61.5 million bushels and 10.2 million bushels would be lost on the acreage shifted to corn. Based on a revenue flexibility coefficient of $0.60 per bushel per 100 million bushel change in soybean output, the 71.7 million bushel reduction would result in a $.43 per bushel price increase. The 1974-76 average soybean price was $5.64 per bushel.

The shifting of 0.34 million acres from soybeans to corn would increase corn production 31.3 million bushels. This increase would result in an estimated decline in corn prices of 2.2 cents per bushel based on revenue flexibility of $0.069 per bushel per 100 million bushel change in corn output. The 1974-76 average corn price was $2.68 per bushel.

Without trifluralin, weed control costs on the acres remaining in soybeans would increase $150 million -- $7.76 per acre. On the acres shifted to corn, variable production costs would double -- $14.6 million for soybeans compared to $30.1 million for corn.

The estimated loss for trifluralin users was the greatest in the Delta Region at $183 million or $26.19 per trifluralin treated acre. Losses in the Southeast ($11 million) and Northern Plains ($110 million) are estimated at $4.36 and $23.85 per trifluralin treated acre, respectively.

In the Corn Belt and Lake States, it was estimated that there would be a gain of $25.1 million on the trifluralin treated acres. This gain can be attributed to three factors:

1. The percent decrease in yield without trifluralin was the lowest for all regions: 2.6 percent compared to 6 to 17 percent in the other regions.

2. Weed control costs on the acres remaining in soybeans had the smallest increase per acre.

3. Corn is highly competitive with soybeans in this region.

As with cotton, the most definitive statement that can be made is that the withdrawal of a weed control technology will in the long-run require more resources to produce a given product mix. Because the product mix would change after a cancellation, there is an indexing problem that must be resolved if a comparison of the well being of consumers before and after the cancellation is to be assessed. In addition, a mechanism to simultaneously evaluate the producer and consumer impacts of cancelling trifluralin on all of the affected commodities - cotton, soybeans, corn, fruits and vegetables, and other field crops - is needed, but currently unavailable.

Table 1. Trifluralin cancellation on soybeans: long-run annual impact on users and non-users

Item	Unit	Regions 1/ 2	3	4	5	Total
Acres planted (1974-76 average) 2/	million	5.0	15.7	13.9	17.7	52.3
Acres treated with trifluralin 3/	million	2.5	5.6	7.0	4.6	19.7
Economic impact on trifluralin users:						
Acres remaining in soybeans: 4/	million	2.50	5.26	7.00	4.60	19.36
Soybean production: 5/						
With trifluralin	mil. bu.	65.0	157.8	196.0	128.8	547.6
Without trifluralin	" "	61.1	153.7	162.1	109.2	486.1
Decrease in production	" "	3.9	4.1	33.9	19.6	61.5
Reduction in income:						
Weed control costs:						
Per acre with trifluralin 6/	dollars	8.72	9.54	9.59	6.63	—
Total with trifluralin 7/	mil. dol.	21.8	50.2	67.1	30.5	169.6
Total without trifluralin 8/	" "	37.0	77.2	128.9	76.7	319.9
Increase in costs	" "	15.2	27.1	61.8	46.2	150.3
Value of lost soybeans production 9/	" "	22.0	23.1	191.2	110.5	346.8
Net reduction in income	" "	37.2	50.2	253.0	156.7	497.1
Increase in income:						
Gain from change in soybean price 10/	" "	26.3	66.1	69.7	47.0	209.1
Net income change on acres remaining in soybeans	" "	-10.9	15.9	-183.3	-109.7	-288.0
Acres of soybeans shifted to corn: 11/	million	—	.34	—	—	.34
Income from soybeans production:						
Soybean yield per acre	bushels	—	30	—	—	30
Soybean production	mil. bu.	—	10.2	—	—	10.2
Gross income 9/	mil. dol.	—	57.5	—	—	57.5
Variable cost per acre 12/	dollars	—	42.93	—	—	42.93
Total variable cost	mil. dol.	—	14.6	—	—	14.6
Return over variable costs	" "	—	42.9	—	—	42.9
Income from corn production:						
Corn yield per acre 13/	bushels	—	92	—	—	92
Corn production	mil. bu.	—	31.3	—	—	31.3
Gross income 14/	mil. dol.	—	83.2	—	—	83.2
Variable cost per acre 12/	dollars	—	88.49	—	—	88.49
Total variable cost	mil. dol.	—	30.1	—	—	30.1
Return over variable costs	mil. dol.	—	52.1	—	—	52.1
Change in income on soybean acreage shifted to corn	" "	—	49.2	—	—	49.2
Total change in income on trifluralin treated acres	" "	-10.9	25.1	-183.3	-109.7	-278.8
Economic impact on non-users of trifluralin from:						
Change in price of soybeans 15/	" "	—	—	—	—	337.2
Change in price of corn 16/	" "	—	—	—	—	-122.3
Total impact on non-users	" "					214.9

— Not applicable
1/ Region 2 - Southeast; Region 3 - Corn Belt and Lake States; Region 4 - Delta; and Region 5 - Northern Plains.
2/ Crop Production Annual Summary 1976. U.S. Department of Agricultural SRS, CrPr 2-1(77).
3/ Table 2.
4/ Table 3.
5/ With trifluralin - average yield per planted acre (Table 2) times acres remaining in soybeans. Without trifluralin - Table 3.
6/ Table 2 - total weed control cost divided by acres treated.
7/ Per acre cost times acres remaining in soybeans.
8/ Table 3.
9/ Change in production times base price. The base price was estimated to be $5.64 per bushel (1974-76 weighted average).
10/ Production without trifluralin times $0.43 per bushel. It was estimated that the price of soybeans would increase from $5.64 to $6.07 per bushel as a result of the 7.17 million bushel decrease in output. Change based on revenue flexibility coefficient of $0.60 per bushel per 100 million bushel change in output.
11/ Table 3.
12/ "Costs of Producing Selected Crops in the United States - 1975, 1976, and Projections for 1977", prepared by Economic Research Service, U.S. Department of Agriculture, for the Committee on Agriculture and Forestry, U.S. Senate, January 21, 1977.
13/ Yield per planted acre (1974-76 weighted average) is based on planted acres minus acres harvested for corn silage. Crop Production Annual Summary 1976, U.S. Department of Agriculture, SRS, CrPr 2-1 (77).
14/ It was estimated that the price of corn would decrease from $2.68 (1974-76 weighted average) to $2.658 per bushel as a result of the 31.3 million bushel increase in corn output. Change based on a revenue flexibility coefficient of $0.069 per 100 million bushel change in output.
15/ Non-users of trifluralin produced an average of 784.1 million bushels of soybeans. Price is expected to increase by $0.43 per bushel. Average 1974-76 soybean production 1,341.9 million bushels minus (547.6 million bushels produced with trifluralin on acres remaining in soybean production and 10.2 million bushels on soybean acreage shifted to corn).
16/ Average 1974-76 corn production of 5,555.9 million bushels times the $0.022 reduction in corn price (footnote 14) as a result of increased output.

Table 2. Estimated current trifluralin treated acres, weed control costs, and soybean production, by region

Region and herbicide used	Acres treated 1/	Application rate per acre	Weed control cost 2/		Soybean production 3/	
			Per acre	Total	Per acre	Total
	millions	pounds	dollars	mil. dol.	bushels	mil. bu.
Region 2						
Trifluralin (alone)	1.60	.75	5.91	9.5	26	41.6
Trifluralin + naptalam	.63	.75 + 3.0	14.31	9.0	26	16.4
Trifluralin + metribuzin	.09	.75 + 0.38	12.18	1.1	26	2.3
Trifluralin + chloroxuron	.18	.75 + 1.0	12.41	2.2	26	4.7
Total	2.50			21.8		65.0
Region 3						
Trifluralin (alone)	3.80	.75	5.91	22.5	30	114.0
Trifluralin + metribuzin	.90	.75 + .5	14.16	12.7	30	27.0
Trifluralin + vernolate	.30	.75 + 3.0	14.91	4.5	30	9.0
Trifluralin + chloramben	.30	.75 + 3.0	23.61	7.1	30	9.0
Trifluralin + alachlor + linuron	.30	.75 + 2.0 + 5	22.16	6.6	30	9.0
Total	5.60			53.4		168.0
Region 4						
Trifluralin (alone)	4.20	.75	5.91	24.8	28	117.6
Trifluralin + metribuzin	2.80	.75 + .6	15.81	42.3	28	78.4
Total	7.00			67.1		196.0
Region 5						
Trifluralin (alone)	4.20	.75	5.91	24.8	28	117.6
Trifluralin + metribuzin	.40	.75 + 0.5	14.16	5.7	28	11.2
Total	4.60			30.5		128.8
All regions	19.7			172.8		557.8

--Not applicable

1/ Estimated by National Herbicide Assessment Team for Trifluralin.

2/ Cost of herbicides per pound AI are as follows: Trifluralin - $7.88; naptalam - $2.80; metribuzin - $16.50; chloroxuron - $6.50; vernolate - $3.00; chloramben - $5.90; linuron - $8.60 and alachlor - $4.00

3/ Soybean yield per planted acre with trifluralin estimated by National Herbicide Assessment Team based on 1974-76 average. Crop Production Annual Summary 1976. U.S. Dept. Agr., Statis. Rptg. Serv. CrPr 2-1 (77).

Table 3. Estimated long-run acreage treated, weed control costs and soybean production for alternate herbicides used to replace trifluralin, by region

Region and herbicide used	Acres treated 1/	Application rate per acre 1/	Additional cultivations per acre 1/	Weed control cost 2/ Per acre	Weed control cost 2/ Total	Lint production 3/ Per acre	Lint production 3/ Total
	1,000	pounds		dollars	mil. dol.	pounds	mil. lbs.
Region 2							
Other dinitroanilines	.300	4/	1.0	8.94 5/	2.7	26.0	7.8
Alachlor + naptalam	1.430	2.0 + 3.0	.0	16.40	23.5	26.0	37.2
Alachlor	.125	3.0	1.5	16.32	2.0	24.7	3.1
Alachlor + metribuzin	.330	3.0 + .38	.0	18.27	6.0	22.1	7.3
Vernolate	.205	2.0	1.3	9.74	2.0	20.8	4.3
Cultivation only	.110	---	2.5	7.20	0.8	13.0	1.4
	2.500				37.0		61.1
Region 3							
Other dinitroanilines	.400	4/	1.0	8.99 5/	3.6	29.4	11.8
Alachlor	2.090	2.5	1.0	12.88	26.9	29.4	61.4
Alachlor + metribuzin	1.470	2.0 + 0.5	1.0	19.13	28.1	30.0	44.1
Vernolate	.370	3.0	1.0	11.88	4.4	28.2	10.4
Chloramben	.370	3.0	1.0	20.58	7.6	28.5	10.5
Alachlor + linuron	.370	2.0 + 0.5	1.0	15.18	5.6	29.4	10.9
Cultivation only	.190	---	2.0	5.76	1.1	24.0	4.6
Diverted to corn	.340	---	---	---	---	---	---
	5.600				77.3		153.7
Region 4							
Other dinitroanilines	.700	4/	1.0	8.98 5/	6.3	28.0	19.6
Alachlor + metribuzin	1.218	3.0 + 1.0	1.0	31.38	38.2	27.4	33.4
Alachlor	1.890	3.0	2.0	17.76	33.6	25.2	47.6
Metribuzin	.714	0.6	2.5	17.10	12.2	22.4	16.0
Vernolate	1.134	2.0	2.5	13.20	15.0	22.4	25.4
Linuron	.378	3.0	2.5	33.00	12.5	21.0	7.9
Cultivation only	.966	---	4.0	11.52	11.1	12.6	12.2
	7.000				128.9		162.1
Region 5							
Other dinitroanilines	.100	4/	1.0	8.99 5/	.9	26.6	2.7
Alachlor + metribuzin	2.292	2.0 + 0.5	1.0	19.13	43.8	23.8	54.5
Chloramben	.566	3.0	1.0	20.53	11.6	23.0	13.0
Alachlor	.566	3.0	1.0	14.88	8.4	23.0	13.0
Vernolate	.916	3.0	1.0	11.88	10.9	25.2	23.1
Cultivation only	.084	---	2.3	6.62	.6	19.6	1.6
Delayed planting	.076	---	2.3	6.62	.5	16.8	1.3
	4.600				76.7		109.2
All Regions	19.700				319.9		486.1

-- Not applicable
1/ Estimated by National Herbicide Assessment Team for Trifluralin.
2/ Treatment costs include \$2.88 per acre for each cultivation. Herbicide costs per pound a.i. are as follows: naptalam - \$2.00; metribuzin - \$16.50; vernolate - \$3.00; chloramben - \$5.90; linuron - \$8.60; alachlor - \$4.00; fluchloralin - \$6.50; dinitramine - \$11.24; pendimethalin - \$6.38; and profluralin - \$7.52.
3/ Soybean yield per planted acre without trifluralin estimated by National Herbicide Assessment Team based on yield with trifluralin (Table 2).
4/ The other dinitroanilines with application rates per acre used to replace trifluralin include: fluchloralin - .9 lbs. a.i.; dinitramine - .5 lbs. a.i.; pendimethalin - 1.0 lbs. a.i.; and profluralin - .8 lbs. a.i.
5/ A composite treatment cost per acre (application rate x price per lb. a.i.) was developed based on a weighted average that considered an estimated market share for each dinitroaniline.

LONG-RUN ECONOMIC IMPACT ANALYSIS ON FRUITS AND VEGETABLES 1/

by

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The estimated long-run economic impact of a trifluralin cancellation to fruit and vegetable producers in the U.S. was based on the following procedures and assumptions:

1. Trifluralin and trifluralin combinations are applied once during the growing season. Trifluralin is applied as a preplant-broadcast-incorporated treatment.
2. U.S. 1974-76 average planted acreage and yield per planted acre were used as a base for the analysis.
3. The base acreage treated with trifluralin was estimated by agricultural scientists using published data, when available, and their knowledge of herbicide use patterns for the crops considered (Table 2).
4. Alternative methods of weed control were specified by agricultural scientists (USDA, Biological Information in Support of Economic Analysis, 1977). These alternatives were assumed to be the most viable if trifluralin were not available (Table 3). In making this determination; the efficacy, market availability, and treatment costs per acre of alternatives were considered.

1/ Crops considered in the analysis were: potatoes, tomatoes, peas, snap beans, lima beans, cabbage, broccoli, Brussels sprouts, cauliflower, carrots, peppers, celery, watermelons, cantaloupes and honey dews, mint, southern peas, collards and okra, and cucumbers.

5. The prices for alternative herbicides would not change and these herbicides would be available in sufficient quantities for the trifluralin treated acreage. Also, sufficient labor would be available for mechanical and hand weed control at prevailing market prices.
6. The number of trifluralin treated acres allocated to the various weed control programs for each crop was estimated by agricultural scientists.
7. Production losses were estimated by the agricultural scientists when alternative weed control programs were not considered as effective as trifluralin. These estimates were based on their experience and judgment about annual variations in production associated with different herbicides and mechanical controls under general field conditions and data from experimental research plots. However, research plot data may vary from actual field experience because they are obtained under specialized conditions.
8. Commodity prices were 1974-76 weighted averages for the United States. Change in commodity price was not estimated for processing peas.

Results

Trifluralin is used extensively in the production of fruits and vegetables. If cancelled, the estimated increase in production costs and value of lost output would be \$36.3 million on the 1.1 million acres of fruits and vegetables subject to the impact (Table 1). The additional

production cost for the crops considered was estimated at $25.9 million: $16.0 for hand weeding; $5.9 million of alternative herbicides; and $4.0 million for mechanical cultivation. Loss in value of production was estimated for only one crop, processing peas, and amounted to $10.4 million. The average impact per acre was estimated to be $32.

Trifluralin use on the crops considered ranged from about 2 percent of the total U.S. planted cucumber acres to about 90 percent for lima beans, collard and okra and southern peas. Trifluralin use on many crops ranged from 40 to 65 percent of planted acreage.

On a per acre basis the estimated increase in production costs and value of lost output ranged from about $5.38 for potatoes to $94.92 for collards and okra. For a majority of the crops the impact ranged from $30 to $60 per acre.

Trifluralin is used on a large proportion of the planted acres of the considered fruits and vegetables. Because of the nature of the growing and processing industry, the impact of a trifluralin cancellation ($36.3 million) would be largely shifted to consumers.

Table 1. Long-run economic impacts of the possible cancellation of trifluralin on U.S. fruit and vegetable producers

Crop	Acres impacted		Change in herbicide treatment cost	Change in mechanical cultivation cost	Change in hand weeding cost	Total change in production costs	Total change in value of output 1/	Total change in production costs and value of output	Change in production costs and value of output per acre
	Number	Percent of U.S.							
			1,000 dollars						dollars
Potatoes	72,000	5.3	171	216	--	287	--	387	5.38
Tomatoes	337,250	68.8	-1,993	730	8,768	7,505	--	7,505	22.25
Peas	131,610	30.0	-462	--	--	-462	-10,398	9,936	75.50
Snap beans	178,652	47.1	1,062	715	--	1,777	--	1,777	9.95
Lima beans	65,290	90.3	809	455	549	1,813	--	1,813	27.77
Cabbage	73,268	66.5	1,618	733	762	3,113	--	3,113	42.49
Broccoli	33,226	65.0	613	332	432	1,377	--	1,377	41.44
Brussels sprouts	3,640	65.0	60	36	47	143	--	143	39.29
Cauliflower	18,147	54.6	335	181	236	752	--	752	41.44
Carrots	31,526	40.3	775	--	410	1,185	--	1,185	37.59
Peppers	20,395	37.8	108	--	1,061	1,169	--	1,169	57.32
Celery	13,510	19.4	223	--	141	364	--	364	26.94
Watermelons	20,000	3.3	547	--	208	755	--	755	37.75
Cantaloupes and honey dews	55,950	63.2	1,289	--	436	1,725	--	1,725	30.83
Mint	7,040	7.7	141	--	--	141	--	141	20.03
Southern peas	67,250	89.4	570	471	2,098	3,139	--	3,139	46.68
Collards and okra	9,450	90.0	-47	117	827	897	--	897	94.92
Cucumbers	4,130	2.1	95	--	32	127	--	127	30.75
Total	1,142,334		5,914	3,986	16,007	25,907	-10,398	36,305	31.78

-- not applicable

1/ Assumes an average pea yield of 1.3 tons/acre in the U.S. and a three year average price of $204/ton. Average yields were estimated to decline by 5% on profluralin treated acres, 20% on the 58,620 dalapon treated acres, and 40% on 72,990 acres that were only cultivated.

Table 2. Estimated current trifluralin use and treatment costs for U.S. fruits and vegetable crops

Crops	Trifluralin control programs		
	Number of acres	Trifluralin treatment per acre	Herbicide treatment per acre 1/
Potatoes	45,000	.75 lb. a.i.	$ 5.91
	27,000	.5 + 3.0 lb. a.i. 2/	12.94
Tomatoes	190,450	.75 lb. a.i.	5.91
	146,800	4.0 lb. a.i. 3/	32.00
Peas	131,610	.6 lb. a.i.	4.73
Snap beans	178,652	.6 lb. a.i.	4.73
Lima beans	65,290	.6 lb. a.i.	4.73
Cabbage	73,268	.75 lb. a.i.	5.91
Broccoli	33,226	.5 lb. a.i.	3.94
Brussels sprouts	3,640	.75 lb. a.i.	5.91
Cauliflower	18,147	.5 lb. a.i.	3.94
Carrots	31,526	.75 lb. a.i.	5.91
Peppers	20,395	.75 lb. a.i.	5.91
Celery	13,510	.75 lb. a.i.	5.91
Watermelons	20,000	.75 lb. a.i.	5.91
Cantaloupes and honey dews	55,950	.75 lb. a.i.	5.91
Mint	7,040	.75 lb. a.i.	5.91
Southern peas	67,250	.75 lb. a.i.	5.91
Collards and okra	9,450	.75 lb. a.i.	5.91
Cucumbers	4,130	.75 lb. a.i.	5.91

1/ Cost of trifluralin treatments per pound a.i. are as follows: trifluralin - $7.88; EPTC - $3.00; diphenamid - $8.00.

2/ Trifluralin + EPTC.

3/ Trifluralin + diphenamid.

Table 3. Estimated long-run use and treatment costs of trifluralin alternatives for U.S. fruit and vegetable crops

Crop	Number of acres	Herbicide treatment per acre 1/	Additional cultivations per acre 2/	Additional hours of hand weeding per acre 3/	Treatment cost per acre
		Alternative weed control program			
Potatoes	28,800	EPTC (4.0 lb. a.i.)	1	—	$15.00
	14,400	linuron (1.5 lb. a.i.)	1	—	15.90
	7,200	DNBP (4.5 lb. a.i.)	1	—	14.16
	14,400	alachlor (2.0 lb. a.i.)	1	—	11.00
	7,200	metribuzin (.5 lb. a.i.)	1	—	11.25
Tomatoes	22,854	diphenamid (4.0 lb. a.i.)	2	10	60.00
	9,522	chloramben (3.5 lb. a.i.)	2	10	56.12
	142,199	napropamide (1.0 lb. a.i.)	—	10	34.00
	162,675	pebulate (4.0 lb. a.i.)	—	10	38.00
Peas	11,724	profluralin (.75 lb. a.i.)	—	—	5.72
	46,896	dalapon (1.0 lb. a.i.)	—	—	2.00
	72,990	none	—	—	—
Snap beans	35,730	profluralin (.75 lb. a.i.)	—	—	5.72
	128,630	EPTC (4.0 lb. a.i.)	1	—	17.00
	14,292	DNBP (4.5 lb. a.i.)	1	—	16.16
Lima beans	13,058	profluralin (.75 lb. a.i.)	—	1	8.32
	8,030	chloramben (2.0 lb. a.i.)	1	4	26.90
	41,525	chloramben (4.0 lb. a.i.)	2	4	43.40
	2,677	dinitramine (.3 lb. a.i.)	—	—	3.37
Cabbage	73,268	nitrofen (5.0 lb. a.i.)	2	4	48.40
Broccoli	33,226	nitrofen (4.0 lb. a.i.)	2	5	45.40
Brussels sprouts	3,640	nitrofen (4.0 lb. a.i.)	2	5	45.40
Cauliflower	18,147	nitrofen (4.0 lb. a.i.)	2	5	45.40
Carrots	15,763	nitrofen (4.0 lb. a.i.)	—	5	35.40
	15,763	oil (40 gal.)+ linuron (1.0 lb. a.i.)	—	5	51.60
Peppers	4,079	diphenamid (4.0 lb. a.i.)	—	20	76.00
	16,316	napropamide (1.0 lb. a.i.)	—	20	60.00
Celery	13,510	nitrofen (4.0 lb. a.i.)	—	4	32.80
Watermelons	20,000	bensulide (4.0 lb. a.i.) + naptalam (4.0 lb. a.i.)	—	4	43.64
Cantaloupes and honey dews	55,950	bensulide (5.0 lb. a.i.) + naptalam (2.0 lb. a.i.)	—	3	36.75
Mint	7,040	terbacil (1.6 lb. a.i.)	—	—	26.00
Southern peas	13,450	profluralin (.75 lb. a.i.)	1	15	10.72
	53,800	chlorpropham (5.0 lb. a.i.)	1.5	15	63.05
Collards	1,350	none	3	40	119.00
Okra	1,620	profluralin (.75 lb. a.i.)	—	3	13.52
	6,480	none	3	40	119.00
Cucumbers	4,130	bensulide (5.0 lb. a.i.) + naptalam (2.0 lb. a.i.)	—	3	36.75

— not applicable

1/ Costs of alternative herbicides per pound active ingredient, except for oil, are as follows:

alachlor - $4.00
bensulide - $4.11
chloramben - $5.75
chlorpropham - $3.31
dalapon - $2.00
dinitamine - $11.24
diphenamid - $6.00
DNBP - $2.48
EPTC - $3.00
linuron - $8.60
metribuzin - $16.50
napropamide - $8.00
naptalam - $4.20
nitrofen - $5.60
oil - .75/gallon
pebulate - $3.00
profluralin - $7.62
terbacil - $16.25

2/ Costs of a mechanical cultivation per acre are as follows: Potatoes - $3.00 and all other crops - $5.00.

3/ Cost of hand weeding labor is $2.60 per hour.

LONG-RUN ECONOMIC IMPACT ANALYSIS ON FIELD CROPS

by

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H. Gaede, Economist, EPA

The estimated long-run economic impact of a trifluralin cancellation on dry beans, peanuts, sugar beets, and sunflowers was based on the following procedure and assumptions:

1. Trifluralin and trifluralin combinations are applied once during the growing season. Trifluralin is applied as a preplant-broadcast-incorporated treatment.
2. U.S. 1974-76 average planted acreage and yield per planted acre were used as a base for the analysis.
3. The base acreage treated with trifluralin was estimated by agricultural scientists using published data, when available, and their knowledge of herbicide use patterns for the crop considered (Table 2).
4. Alternative methods of weed control were specified by agricultural scientists (Table 3). These alternatives were assumed to be the most viable if trifluralin were not available. In making this determination, the efficacy, market availability, and treatment cost per acre of alternatives were considered.
5. The prices for alternative herbicides would not change and these herbicides would be available in sufficient quantities

for the trifluralin treated acreage. Also, sufficient labor would be available for mechanical and hand weed control at prevailing market prices.

6. The number of trifluralin treated acres allocated to the various weed control programs for each crop was estimated by agricultural scientists.

7. Production losses were estimated by the agricultural scientists when alternative weed control programs were not considered as effective as trifluralin (USDA, Biological Information in Support of Economic Analysis, 1977). This amounted to 5-10 percent for sunflower and 5-15 percent for peanuts. For dry beans, yield losses from weed competition were estimated to range from 0 to 7 percent. In Idaho, it was estimated that there would be additional yield losses of 0 to 20 percent at harvest time due to shattering. For sugar beets, it was assumed that yields would not change. These estimates were based on their experience and judgment about annual variations in production associated with the use of different herbicides and mechanical control practices under general field conditions and data from experimental research plots. However, research plot data may vary from actual field experience because they are obtained under specialized conditions.

8. Commodity prices were 1974-76 weighted averages for the United States. No changes in commodity prices were estimated.

Results

Trifluralin is an important herbicide on the field crops considered. The impact of a trifluralin cancellation was estimated at $97.2 million--$53.9 million in added production costs and $43.3 million from value of lost output (Table 1). The impacted area totaled 2.45 million acres. The impact per acre ranged from about $17 for sunflowers to $49 for peanuts.

Trifluralin treated acres, as a percent of planted acreage, were as follows: dry beans - 79.2 percent; peanuts - 19.6 percent; sugar beets - 19.3 percent; and sunflowers - 65.0 percent.

Production costs were estimated to increase $53.9 million for the four crops--$7.4 million from added cultivation, $48.5 million for hand labor, and a decrease of $1.9 million for alternative herbicides. Dry bean and sugar beet producers would also be impacted adversely because the need for additional hand labor--$39.6 million annual cost or about $32 per acre for dry beans and $8.7 million annual cost or about $33 per acre for sugar beets. Non-availability of hand labor could cause a shift of some acres to alternate crops. In the longer term, most of the $97.2 million impact would be shifted to consumers.

Table 1. Long-run economic impact of the possible cancellation of trifluralin on other U.S. field crop producers

Crop	Acres impacted		Change in herbicide treatment cost	Change in mechanical cultivation cost	Change in hand weeding cost	Total change in production cost	Total change in value of output	Total change in production cost and value of output	Change in production cost and value of output per acre
	Number	Percent of U.S.							
			------------------------	Thousand dollars	------------------------				Dollars
Dry beans	1,232,000	79.2	-6,903	--	39,640	32,737	-26,935 1/	59,672	48.44
Peanuts	301,000	19.6	979	2,972	80	4,031	-10,692 2/	14,723	48.91
Sugar beets	264,880	19.3	421	2,649	8,741	11,811	--	11,811	44.59
Sunflowers	650,000	65.0	3,569	1,800	--	5,369	-5,670 3/	11,039	16.98
Total	2,447,880		-1,934	7,421	48,461	53,948	-43,297	97,245	39.73

-- Not applicable.

1/ For all States, except Idaho, a 811,500 cwt. reduction in output valued at \$18.65 per cwt. (1974-76 average). For Idaho, value of production on impacted acres is \$34,857,000. Without trifluralin, value of production in these acres is \$23,056,000 (based on a 7 percent yield loss, 20 percent harvest shatter loss and a quality loss of \$2.00 per cwt.).

2/ 59.4 million pound reduction in peanut output valued at \$.18 per pound (1974-76 average).

3/ 472,500 cwt. reduction in sunflower output valued at \$12 per cwt. (1974-76 average).

Table 2. Estimated current trifluralin use and treatment costs for other U.S. field crops

Crop	Trifluralin control program: Number of acres	Trifluralin treatment per acre 1/	Herbicide treatment cost per acre
Dry beans	5,040 2/	Trifluralin (.5 lb. a.i.)	$ 3.94
	36,960	Trifluralin (.75 lb. a.i.)	5.91
	142,830 2/	Trifluralin (.5 lb. a.i.) + EPTC (3.0 lb. a.i.)	12.94
	418,870	Trifluralin (.75 lb. a.i.) + EPTC (3.0 lb. a.i.)	14.91
	418,870	Trifluralin (.75 lb. a.i.) + alachlor (2.5 lb. a.i.)	15.91
	104,715	Trifluralin (.75 lb. a.i.) + chloramben (2.0 lb. a.i.)	17.41
	104,715	Trifluralin (.75 lb. a.i.) + DNBP (8.0 lb. a.i.)	25.75
Peanuts	236,500	Trifluralin (.5 lb. a.i.)	3.94
	32,250	Trifluralin (.5 lb. a.i.) + alachlor (2.5 lb. a.i.)	13.94
	32,250	Trifluralin (.5 lb. a.i.) + vernolate (2.5 lb. a.i.)	11.44
Sugar beets	264,880	Trifluralin (.75 lb. a.i.)	5.91
Sunflowers	650,000	Trifluralin (.75 lb. a.i.)	5.91

1/ Cost of herbicides per pound a.i. are as follows: trifluralin - \$7.88; EPTC - \$3.00; alachlor - \$4.00; chloramben - \$5.75; and DNBP - \$2.48.

2/ California only.

Table 3. Estimated long-run use and treatment costs of trifluralin alternatives for other U.S. field crops

Crop	Alternative weed control programs				
	Number of crops	Alternative treatment per acre 1/	Additional cultivation per acre 2/	Additional hours of hand weeding per acre 3/	Treatment cost per acre
Dry beans	8,400 4/	Profluralin (.5 lb. a.i.)	--	12	$36.81
	30,800	Profluralin (.75 lb. a.i.)	--	12	38.72
	30,800	Dinitramine (.5 lb. a.i.)	--	--	5.62
	548,480	EPTC (3.0 lb. a.i.)	--	12	42.00
	409,010	Alachlor (2.5 lb. a.i.)	--	12	43.00
	102,255	Chloramben (2.0 lb. a.i.)	--	12	44.50
	102,255	DNBP (8.0 lb. a.i.)	--	12	52.84
Peanuts	6,500	Dinitramine (.5 lb. a.i.)	--	--	5.62
	209,625	Alachlor (2.5 lb. a.i.)	2	--	20.00
	79,550	Vernolate (2.5 lb. a.i.)	2	--	17.50
	5,325	Mechanical cultivation and hand weeding	3	5/	30.00
Sugar beets	264,800	EPTC (2.5 lb. a.i.)	2	12	50.50
Sunflowers	300,000	EPTC (3.0 lb. a.i.)	1	--	12.00
	300,000	Chloramben (2.5 lb. a.i.)	1	--	17.75
	50,000	Profluralin (.75 lb. a.i.)	--	--	5.72

-- Not applicable.
1/ Costs of alternative herbicides per pound of a.i. are as follows: alachlor - $4.00; chloramben - (sunflowers) - $5.90; chloramben (dry beans) - $5.75; dinitramine - $11.24; EPTC - $3.00; profluralin - $7.62; and vernolate - $3.00.
2/ Costs of mechanical cultivation per acre were $3.00 for sunflowers and $5.00 for peanuts and sugar beets.
3/ Cost of hand weeding is $2.75 per hour.
4/ California only.
5/ Assumes additional hand weeding labor costs $15.00 per acre for peanuts.

SHORT-RUN ECONOMIC
ANALYSIS

SHORT-RUN ECONOMIC ANALYSIS

OF

TRIFLURALIN

United States Department of Agriculture
Economic Research Service

and

State Land Grant Universities

and

United States Environmental Protection Agency
Economic Analysis Branch

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CONTENTS

SUMMARY

If trifluralin is suspended, the income of agricultural producers would likely decline \$597.1 million dollars in the short-run as a result of increased production costs and reduced yields. The loss of income for users of trifluralin was estimated at \$414.9 million: \$76.6 million for cotton; \$198.2 million for soybeans; \$38.6 million for fruits and vegetables; and \$101.5 million for dry beans, peanuts, sugar beets and sunflowers. Additional costs for weed control were estimated to increase \$5.9 million for cotton; \$36.0 million for soybeans; \$27.7 million for fruits and vegetables; and \$55.0 million for dry beans, peanuts, sugar beets and sunflowers. Non-users of trifluralin would have a \$182.2 million income loss due to changes in output and prices. Cotton and soybean prices would increase but would not offset the 25 cent per bushel decline in the price of corn.

About 31.6 million acres would be affected, including 19.7 million acres of soybeans, 10.76 million acres of cotton and other field crops, and 1.14 million acres of fruits and vegetables.

Trifluralin is used on about 8.3 million acres or nearly 70 percent of the planted cotton acreage. If the herbicide is suspended, yields would likely decline about 12 percent on those acres from 450 to about 400 pounds of lint per acre. Total lint production would decline 574 million pounds and total seed production 959 million pounds. Production costs would increase \$5.9 million or about \$.74 per acre.

In estimating the impact on cotton producers two different price elasticities of demand were evaluated. Assuming a base price of 60 cents per pound of lint increases of 6.7 and 11.5 cents per pound resulted. These

increases are believed to represent the least and the greatest price change that would occur as a result of a trifluralin suspension, assuming other factors are constant. Taking the midpoint of the estimates, trifluralin users would incur a loss in income of $76.6 million and non-users a gain of $149 million. However, the impact would vary by region. It is estimated that cotton producers in the Delta using trifluralin might gain $117.1 million as a result of a trifluralin suspension. But users of trifluralin in the Southern Plains and Southwest are estimated to have income losses of $94.9 million and $87.4 million, respectively.

An estimated 19.7 million acres of soybeans (38 percent of the planted acreage) were treated with trifluralin. With suspension, 15.2 million acres are expected to remain in soybeans and 4.5 million acres would likely be shifted to corn production. Overall soybean price would increase 24 percent from $5.64 to $6.99 per bushel and corn price would decline 9 percent from $2.68 to $2.43 per bushel.

On the 4.5 million diverted acres, the value of foregone soybean output would be $733 million, offset in part by a $213 million saving in soybean variable production costs and a gain of $448 million in net income from corn. The net effect is a reduction in income of $72 million or $16 per acre. On the remaining 15.2 million treated soybean acres, yields would decline 21 percent from 28 to 22 bushels per acre and weed control costs would increase $36 million or $2.38 per acre. Income would decline $126 million. In total, there would be an income reduction of $198.2 million, or about $10 per acre, on the 19.7 million trifluralin-treated acres traditionally producing soybeans.

The suspension would have external effects on the soybean and corn producers not using trifluralin. Soybean producers not using trifluralin would benefit from the $1.35 per bushel price increase as a result of the suspension, and the value of their output would increase $1,059 million. The value of corn producers' output would decline by $1,390 million because of the 25 cent per bushel reduction in corn price after soybean acres are diverted to corn production. The total impact on soybean and corn producers not using trifluralin would be a reduction in income of $331 million. The total impact on users and non-users producing soybeans and corn would be an income reduction of $529 million.

Trifluralin use varies with different fruit and vegetable crops. Although it is used on only 2 percent of cucumbers, it is applied to 40-65 percent of many other fruits and vegetables and nearly 90 percent of the lima beans, collards and okra, and southern peas. If the trifluralin is suspended, total fruit and vegetable income would decline about $38.6 million. Production costs would increase $27.7 million, including $16.8 million for hand weeding, $6.5 million for alternative herbicides, and $4.4 million for mechanical cultivation. The lost value of output would be $10.9 million because of a yield reduction on processing peas. On a per acre basis, the average impact for most fruits and vegetables would range from $30 to $60. Potatoes would be affected the least at $6.56 per acre, but collards and okra would be impacted at nearly $113 per acre.

Trifluralin is used on 79.2 percent of dry beans, 19.6 percent of the peanut, 19.3 percent of the sugar beets, and 65.0 percent of the sunflower acreage. If the herbicide is suspended, returns on those four crops would likely decline $101.5 million. Production costs would increase $55.0

million--$8.4 million for added cultivation, $49.8 million for hand labor, and a decrease of $3.1 million for alternative herbicides. Nearly 82 percent of the increased hand labor costs would be for dry beans amounting to $33 per acre. The value of output lost on dry beans, peanuts, and sunflower acreage would be $46.4 million.

In addition to the crops discussed above, there are others on which trifluralin is used, including tree fruits and nuts, grapes, guar, and mung beans. Although economic analyses were not undertaken on these commodities because of data limitations, trifluralin use may be important.

INTRODUCTION

The Environmental Protection Agency (EPA) received a petition on February 3, 1977 to suspend the registrations of trifluralin and trichlorobenzoic acid. Trifluralin is a preplant herbicide used extensively on cotton, soybeans, fruits and vegetables, and other field crops. For some crops, suspension of trifluralin use would have large impacts, reducing yields and/or increasing production costs because of less effective herbicides and non-chemical substitutes. However, in other cases, effective substitutes are available for some crops and in some geographical areas, and it is not expected that crop yield or production costs would be adversely affected.

This report examines the short-run economic implications of a possible suspension.

SCOPE

The short-run economic impact of a possible suspension of the principal trifluralin use patterns is analyzed. The major use patterns examined include trifluralin on cotton, soybeans, fruits and vegetables, dry beans, peanuts, sugar beets and sunflowers.

The economic analysis focuses on the changes in income that could result from a suspension. Distribution effects were investigated, where appropriate, for users versus non-users, among regions and between crops. Changes in consumer expenditures for products at the farm level are presented, but changes at the retail level were not investigated. Social or community effects are not investigated, but could occur as a result of economic dislo-

cations associated with income changes, income redistribution and the relocation of agricultural production. The analysis is applicable to the first crop year after a possible suspension.

Partial budgeting was the technique used to perform the short-run economic analysis. The National Herbicide Assessment Team for Trifluralin provided information on acreage treated with trifluralin, weed control input requirements and yield differences for the alternatives most likely to be used in place of trifluralin. Crop acreage, production and commodity prices are based, for the most part, on 1974-76 data. Crop production costs were based on projections for 1977.

Figure 1

OVERALL SUMMARY OF THE SHORT-RUN ECONOMIC EVALUATION OF TRIFLURALIN SUSPENSION (PARTIAL BUDGETING) 1/

Crop/Site	Extent of Use: Million acres treated	Extent of Use: Percent of total acres	Availability of alternative herbicides	Economic Impact: Type	Economic Impact: Million dollars	Economic Impact: Dollars per acre	Significance
Cotton	8.31	70	Several	User 2/	-76.6	-9.22	Major
				Non-user	+149.0	--	
				Total	+72.4	--	
Soybeans	19.7	38	Several	User 3/			
				Acres in soybeans	-126.1	-8.32	
				Acres to corn	-72.1	-15.88	
				Total	-198.2	--	
				Non-users 4/			
				Soybean price change	+1,058.5	--	
				Corn price change	-1,389.7	--	
				Total	-331.2	--	
				Total users and non-users	-529.4	--	Major
Fruits and vegetables	1.15	2.2 to 90	Few for okra and collards; all crops not fully investigated	User 5/	-38.6	-33.76	Major
Other field crops	1.07	9.8 to 65	Several	User 5/	-101.5	41.46	Major
All commodities	30.23	--		Users and non-users	-597.1	--	

-- Not applicable

1/ Based on information contained in Figures 2, 3, 4, and 5.

2/ Midpoint estimate of data from two different price elasticities of demand. The range of the economic impact is as follows:

	E = -1.0	E = -0.3
	--- million dollars ---	
Users	-129.6	+23.6
Non-users	+109.7	+188.3

3/ Based on 15.16 million acres remaining in soybeans and 4.54 million acres shifted to corn.

4/ Based on a price increase of $1.35 per bushel for soybeans and a decrease of 25 cents per bushel for corn.

5/ Dollars per acre taken from Figures 4 and 5.

Figure 2

SUMMARY OF SHORT-RUN BENEFIT ANALYSIS OF TRIFLURALIN USE ON COTTON

A. USE: Cotton

B. MAJOR PESTS CONTROLLED: Several grass and broadleaf weeds

C. ALTERNATIVES:

State recommendations/ Federal guidelines: DCPA, nitralin, diuron, fluometuron, butralin, dinitramine, fluchloralin, profluralin, dalapon, MSMA, paraquat, norflurazon, perfluidone, oil, DSMA, dinoseb, glyphosate, linuron, TCA, and methazole

Non-chemical controls: Cultivation and hoeing

Selected alternatives: Varied by region. Included one application of either fluometuron, diuron, prometryn, norflurazon, DCPA, bensulide, alachlor. All followed by additional cultivations plus cultivations and hoeing without herbicides. In some cases a cropping alternative, such as sorghum, was anticipated.

Comparative costs:

Region	Added cost of weed control: Total (mil. dol.)	Added cost of weed control: Per Acre (dollars)
2	0.6	1.39
4	(-5.9)	(-1.58)
6	7.4	6.83
7	3.8	1.37 a/
All regions	5.9	$.74 a/

a/ Excludes 307,500 acres shifted to grain sorghum.

Comparative performance:

Region	Lint Cotton Yield Per Acre: With Trifluralin (pounds)	Lint Cotton Yield Per Acre: Without Trifluralin (pounds)
2	405	395
4	417	407
6	957	749
7	326	251
All regions	453	399

D. EXTENT OF USE: 1974-1976: 8.31 million acres (70% of planted acres). By region these are .432, 3.724, 1.083 and 3.075.

E. ECONOMIC IMPACTS: USERS ANALYTICAL METHODOLOGY PRODUCERS: Partial budgeting and use of elasticities

Producers: Partial budgeting approach

User:

Region	Change in income Total a/	Per acre
2	+12.2	+28.26
4	+117.1	+31.44
6	-87.4	-80.70
7	-94.9	-34.29 b/
All regions	-76.6	-95.67 b/

a/ Midpoint values of estimates for a -0.3 domestic demand elasticity (Table 1), and a -1.0 combined domestic and foreign demand elasticity (Table 2).

b/ Excludes 307,500 acres shifted to grain sorghum.

Non-User: $149.0 million income gain

Users and Non-Users: $72.4 million income gain

Consumer: Will expend more than the increase in farm value for cotton of $116 million (midpoint) estimate).

Macroeconomic: Not investigated

F. SOCIAL/COMMUNITY IMPACTS: Not investigated

G. LIMITATIONS: Short-run partial equilibrium analysis.

H. PRINCIPAL ANALYSTS AND DATE:

H. Delvo, USDA
T. Eichers, USDA
R. Freund, EPA
H. Gaede, EPA
G. O'Mara, EPA
W. Quinby, USDA
N. Starler, USDA

August 4, 1978

Figure 3

SUMMARY OF SHORT-RUN BENEFIT ANALYSIS OF TRIFLURALIN USE ON SOYBEANS

A. USE: Soybeans

B. MAJOR PESTS CONTROLLED: Several grass and broadleaf weeds

C. ALTERNATIVES:

State recommendations/ Federal guidelines:

States recommend: Several including chlorambe alachlor, linuron, dinitramine, fluchloralin, penoxalin, profluralin, CIPC, metribuzin, dinoseb, 2,4-DB, and fluorodifen

Non-chemical controls: Cultivation and hoeing, rotation to corn, and delayed planting

Selected alternatives: Alachlor and naptalam, alachlor alone, alachlor and metribuzin, vernolate, chloramben, linuron and additional cultivations with last of aforementioned and non-chemical controls listed above.

Comparative costs:

Region	Added cost of weed control a/ Total	Per Acre
	mil. dol.	dollars
2	2.3	1.11
3	0.6	0.16
4	19.1	3.36
5	14.0	3.83
All Regions	36.0	2.37

a/ For acres remaining in soybeans

Comparative performance:

Region	Yield Per Acre With Trifluralin	Without Trifluralin
	- - - - - bushels	- - - - -
2	26	20
3	30	26
4	28	21
5	28	21
All Regions	28	22

D. EXTENT OF USE:	1976: 19.7 million acres - 38% of planted acres.
E. ECONOMIC IMPACTS:	
Analytical methodology:	Partial budgeting and given elasticity
Producers:	
Users:	$198.2 million decrease in users income
Non-users:	$1,058.5 million windfall gain with soybean price increase and $1,390 million decrease with reduced corn revenues; net impact of a $331.2 million decrease in income.
Net impact:	$529.4 million decrease in income
Consumer:	Consumers will pay at least $968 million more for a smaller soybean crop and $518 million less for more corn.
Macroeconomic:	Not investigated
F. SOCIAL/COMMUNITY IMPACTS:	Not investigated
G. LIMITATIONS:	Short-run partial equilibrium analysis
H. PRINCIPAL ANALYSTS AND DATE:	H. Delvo, USDA T. Eichers, USDA R. Freund, EPA H. Gaede, EPA G. O'Mara, EPA A. Paulsen, Iowa State W. Quinby, USDA N. Starler, USDA August 4, 1978

Figure 4

SUMMARY OF SHORT-RUN BENEFIT ANALYSIS OF TRIFLURALIN USE ON FRUITS AND VEGETABLES

A. USE:	Fruits and Vegetables: Potatoes, tomatoes, peas, snap beans, lima beans, cabbage, broccoli, Brussels sprouts, cauliflower, carrots, peppers, celery, watermelons, cantaloupes and honey dews, mint, southern peas, collards and okra, and cucumbers.
B. MAJOR PESTS CONTROLLED:	Several grass and broadleaf weeds
C. ALTERNATIVES:	
<u>State recommendations/ Federal guidelines</u>:	Sample recommendations for the representative crop of tomatoes: pebulate, diphenamid, chloramben, bensulide, DCPA, nitralin, isopropalin, methyl bromide and metham. For peas: DNPB, propachlor, dalapon, CDAA, DCPA. For okra: diphenamid and profluralin. For collards: CDEC and DCPA.
<u>Non-chemical controls</u>:	Mechanical cultivation and hand weeding
<u>Selected alternatives</u>:	Diphenamid, bensulide, naptalam, terbacil, linuron, DNPB, chloramben, napropamide, pebulate, dalapon, EPTC, nitrofen, oil, chlorpropham, mechanical cultivation, and hand weeding.
<u>Comparative costs</u>:	Per acre decrease in revenue (weed control costs and reduced yields) relative to trifluralin ranged from \$6.56 for potatoes to \$113.12 for collards and okra.
D. EXTENT OF USE:	1,142,334 acres for considered crops
E. ECONOMIC IMPACTS:	
<u>User</u>:	Total cost increase and value of output loss of \$38,568,000. \$33.76 per acre.
<u>Consumer</u>:	Producer impacts of \$38,568,000 would be largely shifted to the consumers.

Macroeconomic:	Not investigated
F. SOCIAL/COMMUNITY IMPACTS:	Not investigated
G. LIMITATIONS OF ANALYSIS:	An in-depth study was not conducted
H. PRINCIPAL ANALYSTS AND DATE:	H. Delvo, USDA H. Gaede, EPA August 4, 1978

Figure 5

SUMMARY OF SHORT-RUN BENEFIT ANALYSIS OF TRIFLURALIN
ON OTHER FIELD CROPS

A. USE:	Other field crops: sugar beets, peanuts, and sunflowers
B. MAJOR PESTS CONTROLLED:	Several grass and broadleaf weeds
C. ALTERNATIVES:	
State recommendations/ Federal guidelines:	For dry beans: chloramben, dinitramine, DNBP, EPTC, and alachlor. For peanuts: benefin, dinitramine, vernolate, alachlor, nitralin, diphenamid, chloramben, 2,4-DB, various herbicide combinations and cultivation. Sample recommendations for sugar beets: several including pebulate, cycloate, EPTC, diallate, TCA, barban, dalapon, endothall, desmedipham, pyrazon, phenmedipham, and propham. For sunflowers: EPTC, chloramben, and cultivation.
Non-chemical controls:	Mechanical cultivation and hand weeding
Selected alternatives:	Dry beans: EPTC, alachlor, chloramben, DNBP, and hand weeding. Peanuts: alachlor, vernolate, mechanical cultivation and hand weeding. Sugar beets: EPTC, mechanical cultivation and hand weeding. Sunflowers: chloramben, EPTC, and mechanical cultivation.
Comparative costs:	Change in per acre weed control costs without trifluralin: Dry beans ------ \$27.09 to \$38.06 Peanuts ------- \$11.06 to \$16.06 Sugar beets ---- \$44.59 Sunflowers ----- \$6.09 to \$11.84

D. EXTENT OF USE:	2,447,880 acres: dry beans - 1,232,000 acres (79.2% of planted acres) peanuts - 301,000 acres (19.6% of planted acres) sugar beets - 264,880 acres (19.3% of planted acres) sunflowers - 650,000 acres (65% of planted acres)
E. ECONOMIC IMPACTS:	
User:	Total cost increase and lost value of production \$101,499,000 Dry beans: \$62,576,000 Peanuts: \$15,143,000 Sugar beets: \$11,811,000 Sunflowers: \$11,969,000 Average economic impact per acre of \$41.46 Dry beans - \$50.79 Peanuts - \$50.31 Sugar beets - \$44.59 Sunflowers - \$18.41
Consumer:	Producer impacts of \$101,499,000 may be in part shifted to the consumers
Macroeconomic:	Not investigated
F. SOCIAL/COMMUNITY IMPACTS:	Not investigated
G. LIMITATIONS OF ANALYSIS:	An in-depth study was not conducted
H. PRINCIPAL ANALYSTS AND DATE:	H. Delvo, USDA H. Gaede, EPA August 4, 1978

SHORT-RUN ECONOMIC IMPACT ANALYSIS ON COTTON

by

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The estimated short-run economic impact of a trifluralin suspension on cotton was based on the following procedure and assumptions:

1. Trifluralin and trifluralin combinations are applied once during the growing season. Trifluralin is applied as a preplant-broadcast-incorporated treatment.
2. U.S. 1971-76 average planted acreage and yield per planted acre were used as a base for the analysis.
3. The base acreage treated with trifluralin was estimated by agricultural scientists using published data, when available, and their knowledge of herbicide use patterns for the crops considered (Table 3).
4. Alternative methods of weed control were specified by agricultural scientists (Table 4). These alternatives were assumed to be the most viable if trifluralin were not available. In making this determination, the efficacy of the alternative herbicides and treatment costs per acre were considered.

5. The prices for alternative herbicides would not change and would be available in sufficient quantities for the trifluralin treated acreage in the Southeast and Delta regions. In the Southern Plains and Southwest, alternative herbicides to trifluralin are not in widespread use and might not be available in sufficient quantities. Thus, in the short-run more cotton acreage would be cultivated until herbicide supplies improve. Also sufficient labor would be available for mechanical and hand weed control at prevailing market prices.
6. The number of trifluralin treated acres allocated to the various weed control programs for each crop was estimated by agricultural scientists.

7. Production losses were estimated by the agricultural scientists when alternative weed control programs were not considered as effective as trifluralin (USDA, Biological Information in Support of Economic Analysis, 1977). These estimates were based on their experience and judgment about annual variations in production associated with different herbicides and mechanical controls under general field conditions and data from experimental research plots. However, research plot data may vary from actual field experience because they are obtained under specialized conditions.
8. Cultivation costs by region were derived from the 1975 FEDS Budget prepared by the Economic Research Service, USDA. They range from $1.85 to $2.77 per operation.

9. The base price for lint cotton was assumed to be $0.60 per pound. In determining a new price for lint cotton as a result of trifluralin suspension two procedures were followed.

   a. The domestic market was evaluated assuming that supplies of cotton from export markets would flow to the domestic market in response to supply shortfalls. A price elasticity of demand of -0.3 was used for the domestic market.

   b. Estimates of domestic (-0.3) and foreign (-2.2) demand elasticities were combined based on historic market shares of 65 percent and 35 percent, respectively. This results in a price elasticity of demand of -1.0.

10. The price of cotton seed was assumed to be constant at $0.05 per pound. A demand elasticity coefficient for cottonseed is not available so no estimate of price change was made. However, the decrease in cottonseed and accompanying decrease in soybean production as a result of trifluralin suspension would undoubtedly increase the price of cottonseed.

11. Partial budgeting techniques were used to estimate the short-term (1977 crop year) impact of a trifluralin suspension.

12. The study area included the Southeast, Delta, Southern Plains and Southwest cotton producing regions and are identified as Regions 2, 4, 7 and 6. For the study Missouri was included in Region 4. (Figure 1).

DOANE COUNTRYWIDE FARM PANEL REGIONS

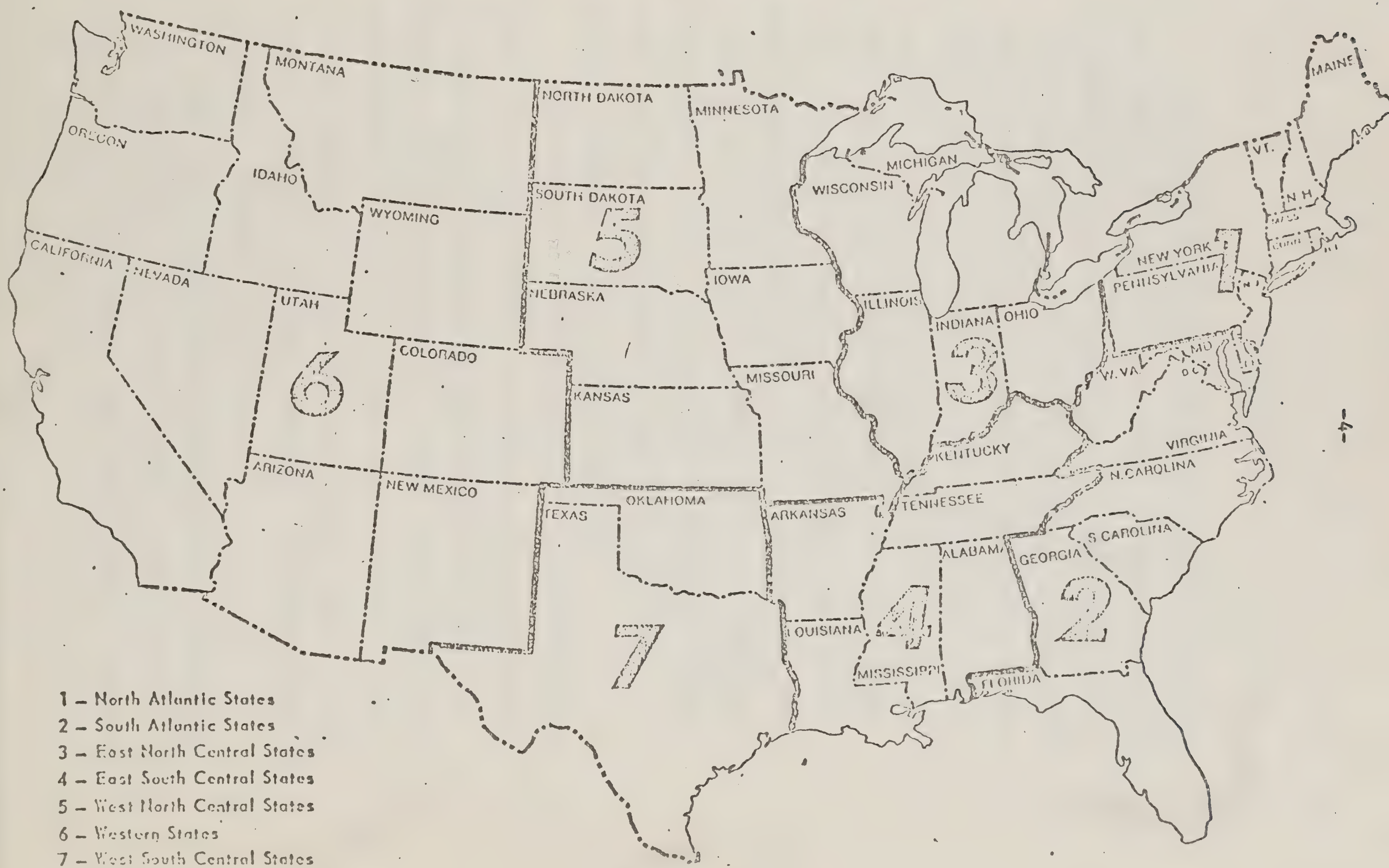

Figure 1

Results

Trifluralin is used on 70 percent of the U.S. cotton acreage either alone or as a mixture. A suspension of trifluralin portends a significant decline in cotton production. The diminished supply capability as reflected by increased costs and decreased yields on trifluralin treated acres will to some extent be offset by increased price for the lint cotton that is produced on these acres. The revenue to cotton producers on non-trifluralin treated acres also will be affected as this cotton will be sold at the higher price. To the producers with non-treated acres, the price rise will be a windfall gain as there will be no offsetting cost increases. Contracting of the cotton crop for a fixed price prior to planting is a common practice. To the extent that cotton farmers have contract their crop, they will not benefit in the short run from price increases resulting from a trifluralin suspension.

An average lint cotton yield decline of 12 percent (decrease from an U. S. average of 450 to 400 pounds per year) is expected. This leads to a 574 million pound reduction in output (Table 1). Regionally, the impact ranges from a decrease in production of 306 million pounds in Region 7 to 4 million pounds in Region 2. The percentage declines (in production) for trifluralin treated acres by region are: Region 2 - 2.3 percent; Region 4 - 2.5 percent; Region 7 - 30.5 percent: and Region 6 - 21.7 percent.

The cost of alternative weed control programs are estimated to increase $5.9 million or $0.74 per trifluralin treated acre as a result of a suspension (Table 4). The largest increase is in Region

7 - \$7.4 million and the smallest in Region 2 - \$0.6 million. On a per acre basis, cost increases are: Region 2 - \$1.39; Region 6 - \$6.83; Region 7 - \$1.37. In Region 4 there is a decrease in production costs when switching to alternative weed control programs of \$5.9 million or \$1.58 per acre. This is because the alternative control programs (herbicides + additional cultivation) are less expensive than the trifluralin mixtures previously used.

Changes in domestic production levels will affect the price farmers receive for cotton and ultimately what consumers pay for cotton products. The magnitude of the price movement is dependent upon the price elasticity of demand for cotton. Fundamentally there are two markets for cotton - the domestic market and the foreign market. In the domestic market, especially over the short term, the price is highly inelastic (-0.2 to -0.3). On the other hand, price is very elastic in the foreign market (-2.0 to -2.5). Unfortunately, an overall (domestic and foreign) price elasticity of demand for cotton has not been estimated.

Consequently it was necessary to develop assumptions about the price elasticity of demand for cotton. Historically, about 35-40% of the cotton crop has been exported. A market share weighting approach suggests that the overall price elasticity might be in the neighborhood of -1.0. This should be viewed as the upper limit in terms of the degree of price elasticity. On the other extreme is the highly inelastic domestic demand. It might be expected that if short falls in production occurred, utilization in the near term would shift from the foreign to domestic market. Such a shift would be constrained by forward export contracts.

In actuality, it is expected the price movement that would be realized lies between these two extremes. Thus the midpoint is used to develop a single point estimate of the relative changes in price that might occur. Following is a more detailed explanation.

Price Elasticity = -0.3;

Under the -0.3 demand elasticity assumption lint cotton prices was estimated to increase from $0.60 to $0.715 per pound. This results from a net decrease in domestic supplies of 196 million pounds.

This decrease in domestic supplies was determined in the following manner.

1. Historically 65 percent of the lint cotton is used in the domestic market and 35 percent goes for export.
2. The decrease in lint cotton production of 574 million would historically be allocated 373 million pounds to the domestic market and 201 million pounds to the export market.
3. Average lint cotton production (1971-76) was 5,403 million pounds, with 1,891 million pounds being exported.
4. The reduction in output from a trifluralin suspension would reduce the amount available for export to 1,690 million pounds (1,891 - 201 million pounds).
5. It was assumed that 80 percent of the exports are contracted. Therefore, to meet these contract commitments 1,513 million pounds of lint cotton would be needed (1,891 million pounds x 80 percent).

6. Since 1,690 million pounds are available for export after suspension, the 1,513 million pounds needed for contract commitments could be met and leave 177 million pounds available for the domestic market.

7. Therefore the net decrease in lint cotton available for the domestic market would be 196 million pounds (373 - 177 million pounds).

8. The long term average domestic utilization of cotton was estimated at 3,512 million pounds. After a trifluralin suspension 3,316 million pounds would be available for the domestic market. The 196 million pound reduction represents a 5.74 percent reduction in the average long term domestic supply. $\left(196 \div \frac{3,512 + 3,316}{2}\right)$

9. The 5.74 percent reduction in domestic supplies was estimated to cause a 19.13 percent increase in lint cotton price, (5.74 percent decrease ÷ -0.3 elasticity of demand). This would amount to a price increase of 11.5 cents per pound, (60 cents x 19.13 percent). Under the -0.3 demand elasticity assumption the effect of a trifluralin suspension on cotton producers is minimized while total consumers' expenditures would increase for a smaller quantity of cotton. On the trifluralin treated acres the economic impact is a gain of $23.6 million as a result of a suspension (Table 1). Trifluralin users would lose lint and seed cotton production valued at $392 million but they would gain $367 million as a result of the $0.115 per pound increases in lint prices.

Cotton producers not using trifluralin would gain about $188 million as a result of the $0.115 per pound increase in lint prices. The net result is that the value of the cotton crop (lint and seed) on all acres would increase $163 million

Although cotton producers as a group gain as the result of trifluralin suspension, not all regions would benefit uniformly. Regions 2 and 4 would gain while losses would be incurred in Region 6 (-$68 million) and Region 7 (-$78 million).

Price Elasticity = -1.0

Under this assumption the domestic and export markets were combined and evaluated. The long term (1971-76 average) cotton supplies available were estimated at 5,403 million pounds after trifluralin suspension 4,829 million pounds would be available. The 574 million pound loss in porduction represents a 11.22 percent decrease $\left(574 - \frac{5,403 + 4,829}{2}\right)$. With an elasticity of demand = 1.0, cotton price was estimated to also increase 11.22 percent. This results in a 6.7 cent per pound increase in cotton prices (60 cents x 11.22 percent). Thus, a result of trifluralin suspension the price of cotton would increase from $0.60 to $0.667 per pound.

Compared to the evaluation using a -0.3 demand elasticity, the assumption of a -1.0 demand elasticity increases the economic impact of a suspension on cotton producers and reduces the impact on consumers. Cotton producers using trifluralin would incur a loss of $130 million (Table 2). The value of lost cotton lint and seed output for trifluralin

users would be the same as before, -$392 million, but this would be partially offset by a gain of $214 million from the 6.7 cent per pound price increase on the cotton produced. Cotton producers not using trifluralin would have increased revenue of about $110 million as a result of the price increase for lint cotton. Thus, the total value of the cotton (lint and seed) crop from all acres would be reduced $68 million as a result of a trifluralin suspension. Consumers expenditures might be less but they would also have less cotton available.

Summary

Clearly, the actual short-run economic impact on cotton producers will depend, other thing equal, on whether the price change is closer to 6.7 cent per pound or 11.5 cents per pound. Assuming that reality lies somewhere in between a significant impact on cotton producers can be expected from a trifluralin suspension.

Taking the midpoint of the estimates, a $76.6 million loss of income for trifluralin users and a $149 million gain for non-users might be expected. At the midpoint the expected value of the cotton crop would be $116 million greater, as a result of a trifluralin suspension and this increase would be paid for by consumers.

It must be cautioned that this analysis is comparative statics. The price changes indicate relative magnitudes and should be used for comparison purposes only. They are not predictions. The real world, even in the short run, is a dynamic system. Many things can happen to magnify or dampen the estimated impacts on cotton producers and consumers. It can be concluded that the suspension of trifluralin just prior to the upcoming planting season increases the uncertainty in a already uncertain business.

Table 1 --Trifluralin suspension on cotton: impact on users and non-users based on a 0.3 price elasticity for domestic demand

Item	Unit	Regions 1/				Total
		2	4	6	7	
Acres planted (1971-76 average)2/	1,000	785	4,138	1,444	5,591	11,958
Economic impact on trifluralin users:						
Acres treated with trifluralin 3/	1,000	432	3,724	1,083	3,075	8,314
Lint cotton production: 4/						
With trifluralin	mil. lbs	175	1,553	1,036	1,002	3,766
Without trifluralin	" "	171	1,514	811	696	3,192
Change in lint production	" "	4	39	225	.306	574
Change in cottonseed production without trifluralin	" "	7	65	376	511	959
Reduction in income:						
Added cost of weed control 6/	mil. dol.	.6	(-5.9)	7.4	3.8	5.9
Value of lost lint cotton 7/	" "	2.4	23.4	135.0	183.6	344.4
Value of lost cottonseed 8/	" "	.4	3.2	18.8	25.6	48.0
Net reduction in revenue	" "	3.4	20.7	161.2	213.0	398.3
Increase in income:						
Gain from change in cotton price 9/	" "	19.7	174.1	93.3	80.0	367.1
Cotton acres diverted to grain sorghum:						
Decrease in variable costs 10/	" "	--	--	--	16.0	16.0
Value of grain sorghum output 11/	" "	--	--	--	38.8	38.8
Net increase in income	" "	19.7	174.1	93.3	134.8	421.9
Net income change on trifluralin treated acres	" "	16.3	153.4	-67.9	-78.2	23.6
Economic impact on non-users of trifluralin from the change in cotton price 12/	" "	--	--	--	--	188.3

-- Not applicable
1/Region 2 - Southeast; Region 4 - Delta; Region 6 - Southwest; and Region 7 - Southern Plains
2/Crop Production Annual Summary 1973 and 1976. U.S. Dept. Agr., Statis. Rptg. Serv. CrPr 2-1 (74) and CrPr 2-1 (77).
3/Table 3.
4/Tables 3 and 4.
5/Change in lint production times 1.67
6/Difference between the trifluralin weed control program costs (Table 3) and the cost of the alternative weed control program (Table 4).
7/The base price for lint cotton was assumed to be \$0.60 per pound.
8/The price for cottonseed was assumed to be constant at \$0.05 per pound.
9/Production without trifluralin times \$0.115 per pound. It was estimated that the price of cotton would increase from \$0.60 to \$0.715 per pound as a result of the reduced output.
10/On the 307,500 cotton acres shifted to grain sorghum (Table 4) the savings in variable costs is \$51.87 per acre. Variable costs for cotton = \$109.29 and grain sorghum \$57.42. Obtained from "Costs Producing Selected Crops in the United States-- 1975, 1976 and Projections for 1977, prepared by the Economic Research Service, USDA for Committee on Agriculture and Forestry, U.S. Senate, January 21, 1977.
11/53 bushels per acre times \$2.38 per bushel (1973-75 weighted average price) times 307,500 acres.
12/Production on non-trifluralin treated acres was estimated at 1,637 million pounds (1971-76 average production of 5,403 million pounds minus 3,766 million pounds produced on trifluralin treated acres-(Table 3). Increase in cotton price was estimated to be \$0.115 per pound (footnote 9).

Table 2--Trifluralin suspension on cotton: impact on users and non-users based on a 1.0 price elasticity of total demand

Item	Unit	Regions 1/ 2	4	6	7	Total
Acres planted (1971-76 average) 2/	1,000	785	4,138	1,444	5,591	11,958
Economic impact on trifluralin users:						
Acres treated with trifluralin 3/	1,000	432	3,724	1,083	3,075	8,314
Lint cotton production: 4/						
With trifluralin	mil. lbs.	175	1,553	1,036	1,002	3,766
Without trifluralin	" "	171	1,514	811	696	3,192
Change in lint production	" "	4	39	225	306	574
Change in cottonseed production without trifluralin	" "	7	65	376	511	959
Reduction in income:						
Added cost of weed control 6/	mil. dol.	.6	(-5.9)	7.4	3.8	5.9
Value of lost lint cotton 7/	" "	2.4	23.4	135.0	183.6	344.4
Value of lost cottonseed 8/	" "	.4	3.2	18.8	25.6	48.0
Net reduction in revenue	" "	3.4	20.7	161.2	213.0	398.3
Increase in income:						
Gain from change in cotton price 9/	" "	11.5	101.5	54.3	46.6	213.9
Cotton acres diverted to grain sorghum:						
Decrease in variable costs 10/	" "	--	--	--	16.0	16.0
Value of grain sorghum output 11/	" "	--	--	--	38.8	38.8
Net increase in income	" "	11.5	101.5	54.3	101.4	268.7
Net income change on trifluralin treated acres	" "	8.1	80.8	-106.9	-111.6	-129.6
Economic impact on non-users of trifluralin from the change in cotton price 12/	" "	--	--	--	--	109.7

-- Not applicable
1/ Region 2 - Southeast; Region 4 - Delta; Region 6 - Southwest; and Region 7 - Southern Plains
2/ Crop Production Annual Summary 1975 and 1976. U.S. Dept. Agr., Statis. Rptg. Serv. CrPr 2-1 (74) and CrPr 2-1 (77).
3/ Table 3.
4/ Tables 3 and 4.
5/ Change in lint production times 1.67
6/ Difference between the trifluralin weed control program costs (Table 3) and the cost of the alternative weed control program (Table 4).
7/ The base price for lint cotton was assumed to be $0.60 per pound.
8/ The price for cottonseed was assumed to be constant at $.05 per pound
9/ Production without trifluralin times $0.067 per pound. It was estimated that the price of cotton would increase from $0.60 to $0.667 per pound as a result of the reduced output.
10/ On the 307,500 cotton acres shifted to grain sorghum (Table 4) the savings in variable costs is $51.87 per acre. Variable costs for cotton - $109.29 and grain sorghum - $57.42. Obtained from "Costs Producing Selected Crops in the United States--1975, 1976 and Projections for 1977, prepared by the Economic Research Service, USDA for Committee on Agriculture and Forestry, U.S. Senate, January 21, 1977.
11/ 53 bushel per acre times $2.38 per bushel (1973-75 weighted average price) times 307,500 acres.
12/ Production on non-trifluralin treated acres was estimated at 1,637 million pounds (1971-76 average production of 5,403 million pounds minus 3,766 million pounds produced on trifluralin treated acres - (Table 3). Increase in cotton price was estimated to be $0.067 per pound (footnote 9).

Table 3--Trifluralin treated acres, weed control costs and lint cotton production, by region.

Region and herbicide used	Acres treated 1/	Application rate per acre	Weed control cost 2/ Per acre	Weed control cost 2/ Total	Lint production 3/ Per acre	Lint production 3/ Total
	1,000	pounds	dollars	mil. dol.	pounds	mil. lbs.
Region 2						
Trifluralin (alone)	78.5	.5	3.75	.3	405	31.8
Trifluralin + fluometuron	176.6	.5 + 1.5	11.73	2.1	405	71.5
Trifluralin + diuron	141.3	.5 + .75	6.00	.8	405	57.2
Trifluralin + prometryn	35.3	.5 + 2.0	11.75	.4	405	14.3
Total	431.7		--	3.6	--	174.8
Region 4						
Trifluralin (alone)	206.9	.75	5.63	1.2	417	86.3
Trifluralin + fluometuron	1,406.9	.75 + 1.5	13.61	19.1	417	586.7
Trifluralin + diuron	1,758.6	.75 + 1.0	8.63	15.2	417	733.3
Trifluralin + prometryn	175.9	.75 + 2.0	13.63	2.4	417	73.4
Trifluralin + norflurazon	175.9	.75 + 2.0	15.63	2.7	417	73.4
Total	3,724.2		--	40.6	--	1,553.1
Region 6						
Trifluralin (alone)	938.6	.75	5.63	5.3	957	898.2
Trifluralin + prometryn	144.4	.75 + 1.6	12.03	1.7	957	138.2
Total	1,083.0		--	7.0	--	1,036.4
Region 7						
Trifluralin (alone)	2,795.5	.75	5.63	15.7	326	911.3
Trifluralin + prometryn	156.5	.75 + 1.5	11.63	1.8	326	51.0
Trifluralin + alachlor	92.2	.75 + 1.5	11.63	1.1	326	30.1
Trifluralin + diuron	30.8	.75 + 1.0	8.63	.3	326	10.0
Total	3,075.0		--	18.9	--	1,002.4
All regions	8,313.9			70.1		3,765.7

-- Not applicable

1/ Estimated by National Herbicide Assessment Team for Trifluralin.

2/ Costs of herbicides per pound AI are as follows: Trifluralin - \$7.50; fluometuron - \$5.32; diuron - \$3.00; prometryn - \$4.00; norflurazon - \$5.00; and alachlor - \$4.00

3/ 1971-76 average yield per planted acre. Calculated from annual crop production summaries, USDA, Statistical Reporting Service, CrPr 2-1 (74) and CrPr 2-1(77).

Table 4 -Alternative herbicides used to replace trifluralin, acreage treated, weed control costs and lint cotton production, by region

Region and herbicide used	Acres treated 1/	Application rate per acre	Additional cultivations per acre	Weed control cost 2/ Per acre	Weed control cost 2/ Total	Lint production 3/ Per acre	Lint production 3/ Total
	1,000	pounds		dollars	mil. dol.	pounds	mil. lbs.
Region 2							
Fluometuron	215.8	1.5	2	12.16	2.6	397	85.7
Diuron	172.7	.75	2	6.43	1.1	393	67.9
Prometryn	43.2	2.0	2	12.18	.5	393	17.0
Total	431.7				4.2	--	170.6
Region 4							
Fluometuron	1,469.0	1.5	2	11.68	17.2	409	600.8
Diuron	1,862.0	1.0	2	6.70	12.5	405	754.1
Prometryn	196.0	2.0	2	11.70	2.3	405	79.6
Norflurazon	196.6	2.0	2	13.70	2.7	405	79.6
Total	3,724.2				34.7	--	1,514.1
Region 6							
DCPA	37.5	9.0	1	34.31	1.3	909	34.1
Bensulide	9.4	2.0	1	10.76	.1	861	8.1
Prometryn	195.0	1.6	1	8.94	1.7	766	149.4
Cultivation (only)	732.8	--	3	7.62	5.6	718	526.2
Cultivation and hand hoeing	108.3	--	3	52.62 5/	5.7	861	93.2
Total	1,083.0				14.4	--	811.0
Region 7							
Prometryn	279.5	1.5	2	9.66	2.7	310	86.6
Alachlor	167.7	1.5	2	9.66	1.6	310	52.0
Diuron	83.9	1.0	2	6.66	.6	293	24.6
Cultivation (only)	1,956.8	--	3	5.49	10.7	228	446.2
Cultivation and hand hoeing	279.6	--	3	25.49 6/	7.1	310	86.7
Grain sorghum 4/	307.5	--	--	--	--	--	--
Total	3,075.0				22.7		696.1
All region	8,313.9				76.0		3,191.8

-- Not applicable

1/ Estimated by National Herbicide Assessment Team for Trifluralin.

2/Treatment costs include additional cost of cultivation and hoeing. Herbicide cost per pound AI are as follows: fluometuron - \$5.32; diuron - \$3.00; prometryn - \$4.00; norflurazon - \$5.00; alachlor - \$4.00; DCPA - \$3.53; bensulide - \$4.11. Cultivation costs are: Region 2 - \$2.09; Region 4 - \$1.85; Region 6 - \$2.54 and Region 7 - \$1.83

3/Lint cotton yield per planted acre without trifluralin estimated by National Herbicide Assessment Team based on yield with trifluralin (table).

4/ The National Herbicide Assessment Team estimated that farmers in Region 7 would shift 10 percent of the cotton acreage to grain sorghum if trifluralin is suspended.

5/ Includes \$45 for hand labor.

SHORT-RUN ECONOMIC IMPACT ANALYSIS ON SOYBEANS

by

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The estimated short-run economic impact of a trifluralin suspension on soybeans was based on the following procedure and assumptions:

1. Trifluralin and trifluralin combinations are applied once during the growing season. Trifluralin is applied as a preplant-broadcast-incorporated treatment.
2. U.S. 1974-76 average planted acreage and yield per planted acre were used as a base for the analysis.
3. The base acreage treated with trifluralin was estimated by agricultural scientists using published data, when available, and their knowledge of herbicide use patterns for the crops considered (Table 2).
4. Alternative methods of weed control were specified by agricultural scientists (Table 3). These alternatives were assumed to be the most viable if trifluralin were not available. In making this determination, the efficacy of the alternative herbicides and treatment costs per acre were considered.
5. The prices for alternative herbicides would not change but they would not be available in sufficient quantities to meet the needs of the trifluralin treated acres. Thus, in the short-run, more soybean acreage would be cultivated until herbicide supplies improve.

Also, sufficient labor would be available for mechanical and hand weeding at prevailing market prices.

6. The number of trifluralin treated acres allocated to the various weed control programs for each crop was estimated by agricultural scientists.
7. Production losses were estimated by the agricultural scientists when alternative weed control programs were not considered as effective as trifluralin. These estimates were based on their experience and judgment about annual variations in production associated with different herbicides and mechanical controls under general field conditions and data from experimental research plots. However, research plot data may vary from actual field experience because they are obtained under specialized conditions.
8. A per acre cost of $2.88 for each additional cultivation was derived from the 1975 FEDS Budget prepared by the Economic Research Service, USDA.
9. The base price estimated for soybeans was $5.64 per bushel and $2.68 per bushel for corn (1974-76 average). Price changes as a result of decreased soybean output were estimated using revenue flexibility coefficients published by ERS, USDA. These coefficients were estimated using a simultaneous equation model and are $0.60 per bushel for soybeans and $0.069 per bushel for corn for each 100 million bushel change in production.
10. The substitution of corn on trifluralin treated soybean acreage was estimated by agricultural scientists to be about 20 percent.

11. Partial budgeting techniques were used to estimate the short-term (1977 crop year) impact of a trifluralin suspension.

12. The study area included the Southeast, Delta, Corn Belt, Lake States, and Northern Plains (Regions 2, 3, 4, and 5 on Figure 1).

Results

Producers' income on trifluralin treated acres was estimated to decrease \$198.2 million as the result of a suspension: \$126.1 million would be incurred on acreage that stayed in soybean production and \$72.1 million on acreage shifted to corn (Table 1). Of the \$126.1 million loss, \$36 million results from increased weed control costs and \$90.1 million from changes in the value of soybean production. The value of decreased yields was estimated at \$538.7 million but they were partially offset by a gain of \$448.6 million from a \$1.35 per bushel increase in the soybean price. The \$72.1 million loss on land shifted to corn is the difference between expected returns from soybeans with trifluralin (\$520.3 million) and the returns from corn (\$448.2 million) taking into account price and production cost changes.

The economic impact on non-users of trifluralin who produce soybeans and corn would be a loss of \$331.2 million. They would gain about \$1.059 billion from an estimated \$1.35 per bushel increase in soybean price, but would lose approximately \$1.390 billion from an estimated 25 cent drop in corn prices. Farmers grow both soybeans and corn so the impact would be spread over more individuals and a wider geographic area than if they specialized in one crop.

Of the 19.7 million acres treated with trifluralin it was estimated that 15.16 million acres would remain in soybeans and 4.54 million acres shifted to corn. Production on the acres remaining in soybeans would decrease 95.5 million bushels and 130 million bushels would be lost on the acreage shifted to corn. Based on a revenue flexibility coefficient of $0.60 per 100 million bushel change in soybean output, the 225.5 million bushel reduction would result in a $1.35 per bushel price increase. The 1974-76 average soybean price was $5.64 per bushel.

The shifting of 4.54 million acres from soybeans to corn would increase production 358.9 million bushels. This increase would result in an estimated decline in corn prices of 25 cents per bushel based on revenue flexibility of $0.69 per 100 million bushel change in corn output. The 1974-76 average corn priee was $2.68 per bushel.

Without trifluralin, weed control costs on the acres remaining in soybeans would increase $36.0 million -- $2.37 per acre. On the acres shifted to corn, variable production costs would double -- $212.9 million for soybeans compared to $448.2 million for corn.

The estimated loss for trifluralin users was the greatest in the Delta region at $155.1 million or -$27.30 per trifluralin treated acre. Losses in the Southeast (-$31.4 million) and Northern Plains (-$77.5 million) are estimated at -$15.10 and -$21.17 per trifluralin treated acre, respectively.

In the Corn Belt and Lake States, it was estimated that there would be a gain of $65.8 million on the trifluralin treated acres. This gain can be attributed to three factors:

(1) The decrease in yield without trifluralin was the lowest for all regions: 3.9 percent compared to 6.4 and 7.4 percent in the other regions.

(2) Weed control costs on the acres remaining in soybeans were similar with ($35.7 million) and without ($36.3 million) trifluralin.

(3) Corn is highly competitive with soybeans in this region.

As with cotton, the most definitive statement that can be made is that the withdrawal of a weed control technology will, in the short-run, require more resources to produce a given product mix. Because the product mix would change after a suspension, there is an indexing problem that must be resolved if a comparison of the well being of consumers before and after the suspension is to be assessed. In addition, a mechanism to simultaneously evaluate the producer and consumer impacts of suspending trifluralin on all of the affected commodities - cotton, soybeans, corn, fruits and vegetables, and field crops is needed, but currently unavailable.

Item	Unit	Regions 1/ 2	3	4	5	Total
Acres planted (1974-76 average) 2/	million	5.0	15.7	13.9	17.7	52.3
Acres treated with trifluralin 3/	million	2.5	5.6	7.0	4.6	19.7
Economic impact on trifluralin users:						
Acres remaining in soybeans: 4/	million	2.08	3.74	5.68	3.66	15.16
Soybean production: 5/						
With trifluralin	mil. bu.	54.1	112.2	159.0	102.5	427.8
Without trifluralin	" "	40.8	97.7	117.2	76.6	332.3
Decrease in production	" "	13.3	14.5	41.8	25.9	95.5
Reduction in income:						
Weed control costs:						
Per acre with trifluralin 6/	dollars	8.72	9.54	9.59	6.63	---
Total with trifluralin 7/	mil. dol.	18.1	35.7	54.5	24.3	132.6
Total without trifluralin 8/	" "	20.4	36.3	73.6	38.3	168.6
Increase in costs	" "	2.3	.6	19.1	14.0	36.0
Value of lost soybeans production 9/	" "	75.0	81.8	235.8	146.1	538.7
Net reduction in income	" "	77.3	82.4	254.9	160.1	574.7
Increase in income:						
Gain from change in soybean price 10/	" "	55.1	131.9	158.2	103.4	448.6
Net income change on acres remaining in soybeans	" "	-22.2	+49.5	-96.7	-56.7	-126.1
Acres of soybeans shifted to corn: 11/	million	.42	1.86	1.32	.94	4.54
Income from soybeans production:						
Soybean yield per acre	bushels	26	30	28	28	---
Soybean production	mil. bu.	10.9	55.8	37.0	26.3	130.0
Gross income 9/	mil. dol.	61.5	314.7	208.7	148.3	733.2
Variable cost per acre 12/	dollars	68.27	42.93	52.52	37.37	---
Total variable cost	mil. dol.	28.7	79.8	69.3	35.1	212.9
Return over variable costs	" "	32.8	234.9	139.4	113.2	520.3
Income from corn production:						
Corn yield per acre 13/	bushels	67	92	69	73	---
Corn production	mil. bu.	28.1	171.1	91.1	68.6	358.9
Gross income 14/	mil. dol.	68.3	415.8	221.4	166.7	872.2
Variable cost per acre 12/	dollars	106.40	88.49	106.40	79.06	---
Total variable cost	mil. dol.	44.7	164.6	140.4	74.3	424.0
Return over variable costs	mil. dol.	23.6	251.2	81.0	92.4	448.2
Change in income on soybean acreage shifted to corn	" "	-9.2	+16.3	-58.4	-20.8	-72.1
Total change in income on trifluralin treated acres	" "	-31.4	+65.8	-155.1	-77.5	-198.2
Economic impact on non-users of trifluralin from:						
Change in price of soybeans 15/	" "	---	---	---	---	+1,058.5
Change in price of corn 16/	" "	---	---	---	---	-1,389.7
						-331.2

1/ Region 2 - Southeast; Region 3 - Corn Belt and Lake States; Region 4 - Delta; and Region 5 - Northern Plains.
2/ Crop Production Annual Summary 1976. U.S. Dept. Agr., Statis. Rptg. Serv. CrPr 2-1 (77).
3/ Table 2.
4/ Table 3.
5/ With trifluralin - average yield per planted acre (Table 2) times acres remaining in soybeans. Without trifluralin - Table 3.
6/ Table 2 - Total weed control cost divided by acres treated.
7/ Per acre cost times acres remaining in soybeans.
8/ Table 3.
9/ Change in production times base price. The base price was estimated to be $5.64 per bushel (1974-76 weighted average).
10/Production without trifluralin times $1.35 per bushel. It was estimated that the price of soybeans would increase from $5.64 to $6.99 per bushel as a result of the 225.5 million bushel decrease in output. Change based on revenue flexibility coefficient of $0.60 per 100 million bushel change in output.
11/Table 3.
12/"Costs of Producing Selected Crops in the United States - 1975, 1976, and Projections for 1977", prepared by Economic Research Service, U.S. Department of Agriculture, for the Committee on Agriculture and Forestry, U.S. Senate, January 21, 1977.
13/Yield per planted acre (1974-76 weighted average) is based on planted acres minus acres harvested for corn silage. Crop Production Annual Summary 1976, U.S. Department of Agriculture, Statis. Rptg. Serv. CrPr 2-1 (77).
14/It was estimated that the price of corn would decrease from $2.68 (1974-76 weighted average) to $2.43 per bushel as a result of the 358.3 million bushel increase in corn output. Change based on a revenue flexibility coefficient of $0.069 per 100 million bushel change in output.
15/Non users of trifluralin produced an average of 784.1 million bushels of soybeans times the price increase of $1.35 per bushel. Average 1974-76 soybean production 1,341.9 million bushels minus (427.8 million bushels produced with trifluralin on acres remaining in soybean production and 130.0 million bushels on soybean acreage shifted to corn).
16/Average 1974-76 corn production of 5,558.9 million bushels times the $0.25 reduction in corn price (footnote 11) as a result of increased [illegible].

Table 3--Alternative herbicides used to replace trifluralin, acreage treated, weed control costs and soybean production, by region

Region and herbicide used	Acres treated 1/	Application rate per acre	Additional cultivations per acre	Weed control cost 2/		Soybean production 3/	
				Per acre	Total	Per acre	Total
	millions	pounds		dollars	mil. dol.	bushels	mil. bu.
Region 2							
Alachlor + naptalam	.45	2.0 + 3.0	0	16.40	7.4	26.0	11.7
Alachlor	.05	3.0	1.5	16.32	.8	24.7	1.2
Alachlor + metribuzin	.11	3.0 + .38	0	18.27	2.0	22.1	2.4
Vernolate	.07	2.0	1.3	9.74	.7	20.8	1.5
Cultivation only	.98	---	2.5	7.20	7.1	13.0	12.7
Rotation with corn	.42	---	2.0	5.76	2.4	26.8	11.3
Diverted to corn	.42	---	---	---	---	----	----
	2.50				20.4		30.8
Region 3							
Alachlor	.61	2.5	1.0	12.88	7.9	29.4	17.9
Alachlor + metribuzin	.48	2.0 + 0.5	1.0	19.13	9.2	30.0	14.4
Vernolate	.13	3.0	1.0	11.88	1.5	28.2	3.7
Chloramben	.13	3.0	1.0	20.58	2.7	28.5	3.7
Alachlor + linuron	.13	2.0 + 0.5	1.0	15.18	2.0	29.4	3.8
Cultivation only	2.26	---	2.0	5.76	13.0	24.0	54.2
Diverted to corn	1.86	---	---	---	---	----	----
	5.60				36.3		97.7
Region 4							
Alachlor + metribuzin	.35	3.0 + 1.0	1.0	31.38	11.0	27.4	9.6
Alachlor	.60	3.0	2.0	17.76	10.7	25.2	15.1
Metribuzin	.24	0.6	2.5	17.10	4.1	22.4	5.4
Vernolate	.36	2.0	2.5	13.20	4.8	22.4	8.1
Linuron	.14	3.0	2.5	33.00	4.6	21.0	2.9
Cultivation only	2.67	---	4.0	11.52	30.8	12.6	33.6
Rotation with corn	1.32	---	2.0	5.76	7.6	32.2	42.5
Diverted to corn	1.32	---	---	---	---	----	----
	7.00				73.6		117.2
Region 5							
Alachlor + metribuzin	.69	2.0 + 0.5	1.0	19.13	13.2	23.8	16.4
Chloramben	.18	3.0	1.0	20.58	3.7	23.0	4.1
Alachlor	.18	3.0	1.0	14.88	2.7	23.0	4.1
Vernolate	.26	3.0	1.0	11.88	3.1	25.2	6.6
Cultivation only	2.10	---	2.3	6.62	13.9	19.6	41.2
Delayed planting	.25	---	2.3	6.62	1.7	16.8	4.2
Diverted to corn	.94	---	---	---	---	----	----
	4.60				38.3		76.6
All regions	19.70				168.6		332.3

--Not applicable.

1/ Estimated by National Herbicide Assessment Team for Trifluralin.

2/ Treatment costs include $2.88 per acre for each additional cultivation. Herbicide costs per pound AI are as follows: Naptalam - $2.80; metribuzin - $16.50; vernolate - $3.00; chloramben - $5.90; linuron - $8.60; and alachlor - $4.00.

3/ Soybean yield per planted acre without trifluralin estimated by National Herbicide Assessment Team based on yield with trifluralin (Table 2).

Table 2--. Trifluralin treated acres, weed control costs and soybean production, by region

Region and herbicide used	Acres treated 1/	Application rate per acre	Weed control cost 2/ Per acre	Weed control cost 2/ Total	Soybean production 3/ Per acre	Soybean production 3/ Total
	millions	pounds	dollars	mil. dol.	bushels	mil. bu.
Region 2						
Trifluralin (alone)	1.60	.75	5.91	9.5	26	41.6
Trifluralin + naptalam	.63	.75 + 3.0	14.31	9.0	26	16.4
Trifluralin + metribuzin	.09	.75 + 0.38	12.18	1.1	26	2.3
Trifluralin + chloroxuron	.18	.75 + 1.0	12.41	2.2	26	4.7
Total	2.50			21.8		65.0
Region 3						
Trifluralin (alone)	3.80	.75	5.91	22.5	30	114.0
Trifluralin + metribuzin	.90	.75 + .5	14.16	12.7	30	27.0
Trifluralin + vernolate	.30	.75 + 3.0	14.91	4.5	30	9.0
Trifluralin + chloramben	.30	.75 + 3.0	23.61	7.1	30	9.0
Trifluralin + alachlor + linuron	.30	.75 + 2.0 + 5	22.16	6.6	30	9.0
Total	5.60			53.4		168.0
Region 4						
Trifluralin (alone)	4.20	.75	5.91	24.8	28	117.6
Trifluralin + metribuzin	2.80	.75 + .6	15.81	42.3	28	78.4
Total	7.00			67.1		196.0
Region 5						
Trifluralin (alone)	4.20	.75	5.91	24.8	28	117.6
Trifluralin + metribuzin	.40	.75 + 0.5	14.16	5.7	28	11.2
Total	4.60			30.5		128.8
All regions	19.7			172.8		557.8

--Not applicable
1/ Estimated by National Herbicide Assessment Team for Trifluralin.
2/ Cost of herbicides per pound AI are as follows: Trifluralin - $7.88; naptalam - $2.80; metribuzin - $16.50; chloroxuron - $6.50; vernolate - $3.00; chloramben - $5.90; linuron - $8.60 and alachlor - $4.00
3/ Soybean yield per planted acre with trifluralin estimated by National Herbicide Assessment Team based on 1974-76 average. Crop Production Annual Summary 1976. U.S. Dept. Agr., Statis. Rptg. Serv. CrPr 2-1 (77).

SHORT-RUN ECONOMIC IMPACT ANALYSIS ON FRUITS AND VEGETABLES 1/

by

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The estimated short-run economic impact of trifluralin suspension to fruit and vegetable producers in the U.S. was based on the following procedures and assumptions:

1. Trifluralin and trifluralin combinations are applied once during the growing season. Trifluralin is applied as a preplant-broadcast-incorporated treatment.
2. U.S. 1974-76 average planted acreage and yield per planted acre were used as a base for the analysis.
3. The base acreage treated with trifluralin was estimated by agricultural scientists using published data, when available, and their knowledge of herbicide use patterns for the crops considered (Table 2).
4. Alternative methods of weed control were specified by agricultural scientists (USDA, Biological Information in Support of Economic Analysis, 1977). These alternatives were assumed to be the most viable if trifluralin were not available (Table 3). In making this determination, the efficacy of the alternative herbicides and treatment costs per acre were considered.

1/ Crops considered in the analysis were: potatoes, tomatoes, peas, snap beans, lima beans, cabbage, broccoli, Brussels sprouts, cauliflower, carrots, peppers, celery, watermelons, cantaloupes and honey dews, mint, southern peas, collards and okra, and cucumbers.

5. The prices for alternative herbicides would not change and these herbicides would be available in sufficient quantities for the trifluralin treated acreage. Also, sufficient labor would be available for mechanical and hand weed control at prevailing market prices.
6. The number of trifluralin treated acres allocated to the various weed control programs for each crop was estimated by agricultural scientists.
7. Production losses were estimated by the agricultural scientists when alternative weed control programs were not considered as effective as trifluralin. These estimates were based on their experience and judgment about annual variations in production associated with different herbicides and mechanical controls under general field conditions and data from experimental research plots. However, research plot data may vary from actual field experience because they are obtained under specialized conditions.
8. Commodity prices were 1974-76 weighted averaged for the United States. Change in commodity price was not estimated for processing peas because almost all of the acreage is subject to contract pricing.

Results

Trifluralin is used extensively in the production of fruits and vegetables. If suspended, the estimated increase in production costs

and value of lost output would be $38.6 million on the 1.14 million acres of fruits and vegetables subject to the impact (Table 1). The additional production cost for the crops considered was estimated at $27.7 million: $16.8 for hand weeding; $6.5 million of alternative herbicides; and $4.4 million for mechanical cultivation. Loss in value of production was estimated for only one crop, processing peas, and amounted to $10.9 million. The average impact per acre was estimated to be $33.76.

Trifluralin use on the crops considered ranged from about 2 percent of the total U.S. planted cucumber acres to about 90 percent for lima beans, collards and okra and southern peas. Trifluralin use on many crops ranged from 40 to 65 percent of planted acreage.

On a per acre basis the estimated increase in production costs and value of lost output ranged from about $6.56 for potatoes to $113.12 of collards and okra. For a majority of the crops the impact ranged from $30 to $60 per acre.

Trifluralin is used on a large proportion of the planted acres of the considered fruits and vegetables. Because of the nature of the growing and processing industry, the impact of a trifluralin suspension ($38.6 million) would be largely shifted to consumers.

Table 1. Short-run economic impacts of the possible suspension of trifluralin on U.S. fruit and vegetable producers

Crop	Acres impacted		Change in herbicide treatment cost	Change in mechanical cultivation cost	Change in hand weeding cost	Total change in production costs	Total change in value of output 1/	Total change in production costs and value of output	Change in production costs and value of output per acre
	Number	Percent of U.S.							
			1,000 dollars						dollars
Potatoes	72,000	5.3	256	216	--	472	--	472	6.56
Tomatoes	337,250	68.8	-1,993	730	8,768	7,505	--	7,505	22.25
Peas	131,610	30.0	- 505	--	--	- 505	-10,852	10,347	78.62
Snap beans	178,652	47.1	1,284	893	--	2,177	--	2,177	12.19
Lima beans	65,290	90.3	1,039	586	679	2,304	--	2,304	35.29
Cabbage	73,268	66.5	1,618	733	762	3,113	--	3,113	42.49
Broccoli	33,226	65.0	613	332	432	1,377	--	1,377	41.44
Brussels sprouts	3,640	65.0	60	36	47	143	--	143	39.29
Cauliflower	18,147	54.6	335	181	236	752	--	752	41.44
Carrots	31,526	40.3	775	--	410	1,185	--	1,185	37.59
Peppers	20,395	37.8	108	--	1,061	1,169	--	1,169	57.32
Celery	13,510	39.4	223	--	141	364	--	364	26.94
Watermelons	20,000	8.3	547	--	208	755	--	755	37.75
Cantaloupes and honey dews	55,950	63.2	1,289	--	436	1,725	--	1,725	30.83
Mint	7,040	7.7	141	--	--	141	--	141	26.56
Southern peas	67,250	89.4	716	504	2,623	3,843	--	3,843	57.14
Collards and okra	9,450	90.0	-56	142	983	1,069	--	1,069	113.12
Cucumbers	4,130	2.1	95	--	32	127	--	127	30.75
Total	1,142,334		6,545	4,353	16,818	27,716	-10,852	38,568	33.76

-- not applicable

1/ Assumes an average pea yield of 1.3 tons/acre in the U.S. and a three year average price of $204/ton. Average yields were estimated to decline by 20% on the 58,620 dalapon treated acres and 40% on 72,990 acres that were only cultivated.

Table 2. Estimated current trifluralin use and treatment costs for U.S. fruits and vegetable crops

Crops	Trifluralin control programs		
	Number of acres	Trifluralin treatment per acre	Herbicide treatment cost per acre 1/
Potatoes	45,000	Trifluralin (.75 lb. a.i.)	$ 5.91
	27,000	Trifluralin (.5 lb. a.i.) + EPTC (3.0 lb. a.i.)	12.94
Tomatoes	190,450	Trifluralin (.75 lb. a.i.)	5.91
	146,800	Trifluralin + diphenamid (4.0 lb. a.i.)	32.00
Peas	131,610	Trifluralin (.6 lb. a.i.)	4.73
Snap beans	178,652	Trifluralin (.6 lb. a.i.)	4.73
Lima beans	65,290	Trifluralin (.6 lb. a.i.)	4.73
Cabbage	73,268	Trifluralin (.75 lb. a.i.)	5.91
Broccoli	33,226	Trifluralin (.5 lb. a.i.)	3.94
Brussels sprouts	3,640	Trifluralin (.75 lb. a.i.)	5.91
Cauliflower	18,147	Trifluralin (.5 lb. a.i.)	3.94
Carrots	31,526	Trifluralin (.75 lb. a.i.)	5.91
Peppers	20,395	Trifluralin (.75 lb. a.i.)	5.91
Celery	13,510	Trifluralin (.75 lb. a.i.)	5.91
Watermelons	20,000	Trifluralin (.75 lb. a.i.)	5.91
Cantaloupes and honey dews	55,950	Trifluralin (.75 lb. a.i.)	5.91
Mint	7,040	Trifluralin (.75 lb. a.i.)	5.91
Southern peas	67,250	Trifluralin (.75 lb. a.i.)	5.91
Collards and okra	9,450	Trifluralin (.75 lb. a.i.)	5.91
Cucumbers	4,130	Trifluralin (.75 lb. a.i.)	5.91

1/ Cost of trifluralin treatments per pound a.i. are as follows: trifluralin - $7.88; EPTC - $3.00; and diphenamid - $8.00.

Table 3. Estimated short-run use and treatment costs of trifluralin alternatives for U.S. fruit and vegetable crops

Crop	Alternative weed control program				
	Number of acres	Herbicide treatment per acre 1/	Additional cultivations per acre 2/	Additional hours of hand weeding per acre 3/	Treatment cost per acre
Potatoes	36,000	EPTC (4.0 lb. a.i.)	1	—	$ 15.00
	21,600	linuron (1.5 lb. a.i.)	1	—	15.90
	14,400	DNBP (4.5 lb. a.i.)	1	—	14.16
Tomatoes	22,854	diphenamid (4.0 lb. a.i.)	2	10	60.00
	9,522	chloramben (3.5 lb. a.i.)	2	10	56.12
	142,199	napropamide (1.0 lb. a.i.)	—	10	34.00
	162,675	pebulate (4.0 lb. a.i.)	—	10	38.00
Peas	58,620	dalapon (1.0 lb. a.i.)	—	—	2.00
	72,990	none	—	—	—
Snap beans	160,787	EPTC (4.0 lb. a.i.)	1	—	17.00
	17,865	DNBP (4.5 lb. a.i.)	1	—	16.16
Lima beans	13,384	chloramben (2.0 lb. a.i.)	1	4	26.90
	51,906	chloramben (4.0 lb. a.i.)	2	4	43.40
Cabbage	73,268	nitrofen (5.0 lb. a.i.)	2	4	48.40
Broccoli	33,226	nitrofen (4.0 lb. a.i.)	2	5	45.40
Brussels sprouts	3,640	nitrofen (4.0 lb. a.i.)	2	5	45.40
Cauliflower	18,147	nitrofen (4.0 lb. a.i.)	2	5	45.40
Carrots	15,763	nitrofen (4.0 lb. a.i.)	—	5	35.40
	15,763	oil (40 gallons) linuron (1.0 lb. a.i.)	—	5	51.60
Peppers	4,079	diphenamid (4.0 lb. a.i.)	—	20	76.00
	16,316	napropamide (1.0 lb. a.i.)	—	20	60.00
Celery	13,510	nitrofen (4.0 lb. a.i.)	—	4	32.80
Watermelons	20,000	bensulide (4.0 lb. a.i.) + naptalam (4.0 lb. a.i.)	—	4	43.64
Cantaloupes and honey dews	55,950	bensulide (5.0 lb. a.i.) + naptalam (2.0 lb. a.i.)	—	3	36.75
Mint	7,040	terbacil (1.6 lb. a.i.)	—	—	26.00
Southern peas	67,250	chlorpropham (5.0 lb. a.i.)	1.5	15	63.05
Collards and okra	9,450	—	3	40	119.00
Cucumbers	4,130	bensulide (5.0 lb. a.i.) + napthalam (2.0 lb. a.i.)	—	3	36.75

— Not applicable

1/ Costs of alternative herbicides per pound active ingredient, except for oil, are as follows:

EPTC	-$3.00	napropamide	- $8.00	bensulide	- $4.11
linuron	- 8.60	pebulate	- 3.00	naptalam	- 4.20
DNBP	- 2.48	dalapon	- 2.00	terbacil	- 16.25
diphenamid	- 6.00	nitrofen	- 5.60	chlorpropham	- 3.31
chloramben	- 5.75	oil	- .75/gallon		

2/ Costs of a mechanical cultivation per acre are as follows: potatoes - $3.00 and all other crops - $5.00.

3/ Cost of hand weeding labor is $2.60 per hour.

SHORT-RUN ECONOMIC IMPACT ANALYSIS ON FIELD CROPS

by

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The estimated short-run economic impact of a trifluralin suspension on dry beans, peanuts, sugar beets, and sunflowers was based on the following procedure and assumptions:

1. Trifluralin and trifluralin combinations are applied once during the growing season. Trifluralin is applied as a preplant-broadcast-incorporated treatment.

2. U.S. 1974-76 average planted acreage and yield per planted acre were used as a base for the analysis.

3. The base acreage treated with trifluralin was estimated by agricultural scientists using published data, when available, and their knowledge of herbicide use patterns for the crop considered (Table 2).

4. Alternative methods of weed control were specified by agricultural scientists (Table 3). These alternatives were assumed to be the most viable if trifluralin were not available. In making this determination, the efficacy of the alternative herbicides and treatment cost per acre were considered.

5. The prices for alternative herbicides would not change and these herbicides would be available in sufficient quantities for the trifluralin treated acreage. Also, sufficient labor would be available for mechanical and hand weed control at prevailing market prices.

6. The number of trifluralin treated acres allocated to the various weed control programs for each crop was estimated by agricultural scientists.

7. Production losses were estimated by the agricultural scientists when alternative weed control programs were not considered as effective as trifluralin (USDA, Biological Information in Support of Economic Analysis, 1977). This amounted to 5-10 percent for sunflowers and 5-15 percent for peanuts. For dry beans, yield losses from weed competition were estimated to be 7 percent. In Idaho, it was estimated that there would be additional losses of 20 percent at harvest time due to shattering. For sugar beets, it was assumed that yields would not change. These estimates were based on their experience and judgment about annual variations in production associated with the use of different herbicides and mechanical control practices under general field conditions and data from experimental research plots. However, research plot data may vary from actual field experience because they are obtained under specialized conditions.

[illegible]

6. [illegible]

7. [illegible]

8. Commodity prices were 1974-76 weighted averages for the United States. No changes in commodity prices were estimated.

Results

Trifluralin is an important herbicide on the field crops considered. The impact of a trifluralin suspension was estimated at $101.5 million--$55.0 million in added production costs and $46.5 from value of lost output (Table 1). The impacted area totaled 2.45 million acres. The impact per acre ranged from about $18 for sunflowers to $51 for dry beans.

Trifluralin treated acres as a percent of planted acreage were as follows: dry beans - 79.2 percent; peanuts - 19.6 percent; sugar beets - 19.3 percent; and sunflowers - 65.0 percent.

Production costs were estimated to increase by about $55.0 million for the four crops--$8.4 million from added cultivation, $49.8 million for hand labor, and a decrease of $3.1 million for alternative herbicides. Dry bean and sugar beet producers would also be impacted adversely because the need for additional hand labor--$40.7 million annual cost or about $33 per acre for dry beans and $8.7 million annual cost or about $33 per acre for sugar beets.

It is reasonable to assume that the producers of the other field crops evaluated would in the short-run bear most, if not all, of the estimated impact of a trifluralin suspension ($101.5 million). In the longer term as adjustments are made some of this impact would be shifted to consumers.

Table 1. Short-run economic impacts of the possible cancellation of trifluralin on other U.S. field crop producers

Crop	Acres impacted		Change in herbicide treatment cost	Change in mechanical cultivation cost	Change in hand weeding cost	Total change in production cost	Total change in value of output	Total change in production cost and value of output	Change in production cost and value of output per acre
	Number	Percent of U.S.							
			Thousand dollars						Dollars
Dry beans	1,232,000	79.2	-6,548	--	40,656	34,108	-28,468 1/	62,576	50.79
Peanuts	301,000	19.6	-890	3,838	355	3,303	-11,840 2/	15,143	50.31
Sugar beets	264,880	19.3	421	2,649	8,741	11,811	--	11,811	44.59
Sunflowers	650,000	65.0	3,877	1,950	--	5,827	-6,142 3/	11,969	18.41
Total	2,447,880		-3,140	8,437	49,752	55,049	-46,450	101,499	41.46

-- Not applicable.

1/ For all States, except Idaho, a 860,400 cwt. reduction in output valued at $18.65 per cwt. (1974-76 average). For Idaho, value of production on impacted acres is $36,532,000. Without trifluralin, value of production on these acres is $24,110,000 (based on a 7 percent yield loss, 20 percent harvest shatter loss and a quality loss of $2.00 per cwt.).

2/ 65.8 million pound reduction in peanut output valued at 18 cents per pound (1974-76 average).

3/ 511,875 cwt. reduction in sunflowers output valued at $12 per cwt. (1974-76 average).

Table 2. Estimated current trifluralin use and treatment costs for other U.S. field crops

Crop	Trifluralin control program: Number of acres	Trifluralin control program: Trifluralin treatment per acre 1/	Trifluralin control program: Herbicide treatment cost per acre
Dry beans	5,040 2/	Trifluralin (.5 lb. a.i.)	$ 3.94
	36,960	Trifluralin (.75 lb. a.i.)	5.91
	142,830 2/	Trifluralin (.5 lb. a.i.) + EPTC (3.0 lb. a.i.)	12.94
	418,870	Trifluralin (.75 lb. a.i.) + EPTC (3.0 lb. a.i.)	14.91
	418,870	Trifluralin (.75 lb. a.i.) + alachlor (2.5 lb. a.i.)	15.91
	104,715	Trifluralin (.75 lb. a.i.) + chloramben (2.0 lb. a.i.)	17.41
	104,715	Trifluralin (.75 lb. a.i.) + DNBP (8.0 lb. a.i.)	25.75
Peanuts	236,500	Trifluralin (.5 lb. a.i.)	3.94
	32,250	Trifluralin (.5 lb. a.i.) + alachlor (2.5 lb. a.i.)	13.94
	32,250	Trifluralin (.5 lb. a.i.) + vernolate (2.5 lb. a.i.)	11.44
Sugar beets	264,880	Trifluralin (.75 lb. a.i.)	5.91
Sunflowers	650,000	Trifluralin (.75 lb. a.i.)	5.91

1/ Cost of herbicides per pound a.i. are as follows: trifluralin - $7.88; EPTC - $3.00; alachlor - $4.00; chloramben - $5.75; and DNBP - $2.48.

2/ California only.

Table 3. Estimated short-run use and treatment costs of trifluralin alternatives for other U.S. field crops

Crop	Number of crops	Alternative weed control programs: Alternative treatment per acre 1/	Additional cultivation per acre 2/	Additional hours of hand weeding per acre 3/	Treatment cost per acre
Dry beans	581,500	EPTC (3.0 lb. a.i.)	--	12	$42.00
	433,660	Alachlor (2.5 lb. a.i.)	--	12	43.00
	108,420	Chloramben (2.0 lb. a.i.)	--	12	44.50
	108,420	DNBP (8.0 lb. a.i.)	--	12	52.84
Peanuts	11,825	No cultivation	--	--	--
	44,075	Alachlor (2.5 lb. a.i.)	2	--	20.00
	55,900	Vernolate (2.5 lb. a.i.)	2	--	17.50
	23,650	Mechanical cultivation and hand weeding	3	4/	30.00
	165,500	Mechanical cultivation	3	--	15.00
Sugar beets	264,800	EPTC (2.5 lb. a.i.)	2	12	50.50
Sunflowers	325,000	EPTC (3.0 lb. a.i.)	1	--	12.00
	325,000	Chloramben (2.5 lb. a.i.)	1	--	17.75

-- Not applicable.
1/ Costs of alternative herbicides per pound of a.i. are as follows: alachlor - $4.00; chloramben (sunflowers) - $5.90; chloramben (dry beans) - $5.75; EPTC - $3.00; vernolate - $3.00; DNBP - $2.48.
2/ Costs of mechanical cultivation per acre were $3.00 for sunflowers and $5.00 for peanuts and sugar beets.
3/ Cost of hand weeding is $2.75 per hour.
4/ Assumes additional hand weeding labor costs $15.00 per acre for peanuts.

MISCELLANEOUS CROPS

In addition to the crops discussed above, there are others on which trifluralin is used. Some of these include tree fruits and nuts, grapes, guar and mung beans. Because of data limitations economic analyses were not undertaken, but this should not be construed to imply that trifluralin use is unimportant on these crops. For tree fruits and nuts, as well as grapes, it is estimated that about 5 percent or less of the acreage is treated with trifluralin to control weeds within the row. Without trifluralin discings and cultivations would be increased, which would cause some root pruning. The impact on yield is unknown.

Guar and mung beans are grown in localized areas of Texas and Oklahoma. They are frequently planted either as catch-crops after wheat or cotton failures or as a second crop following wheat. The acreage planted to guar varies considerably and is dependent on weather conditions. For mung beans there are no published statistics. Trifluralin is registered and recommended for weed control on both crops. However, the extent of use is unknown. The suspension of trifluralin would undoubtedly impact some producers, but because of data limitations, the level of impact was not investigated.